Smithsonian

September 1988

Listening for Neptune

Engineer sprawls on a huge electronic ear that's cocked to hear signals from Voyager, 2.8 billion miles away (p. 42)

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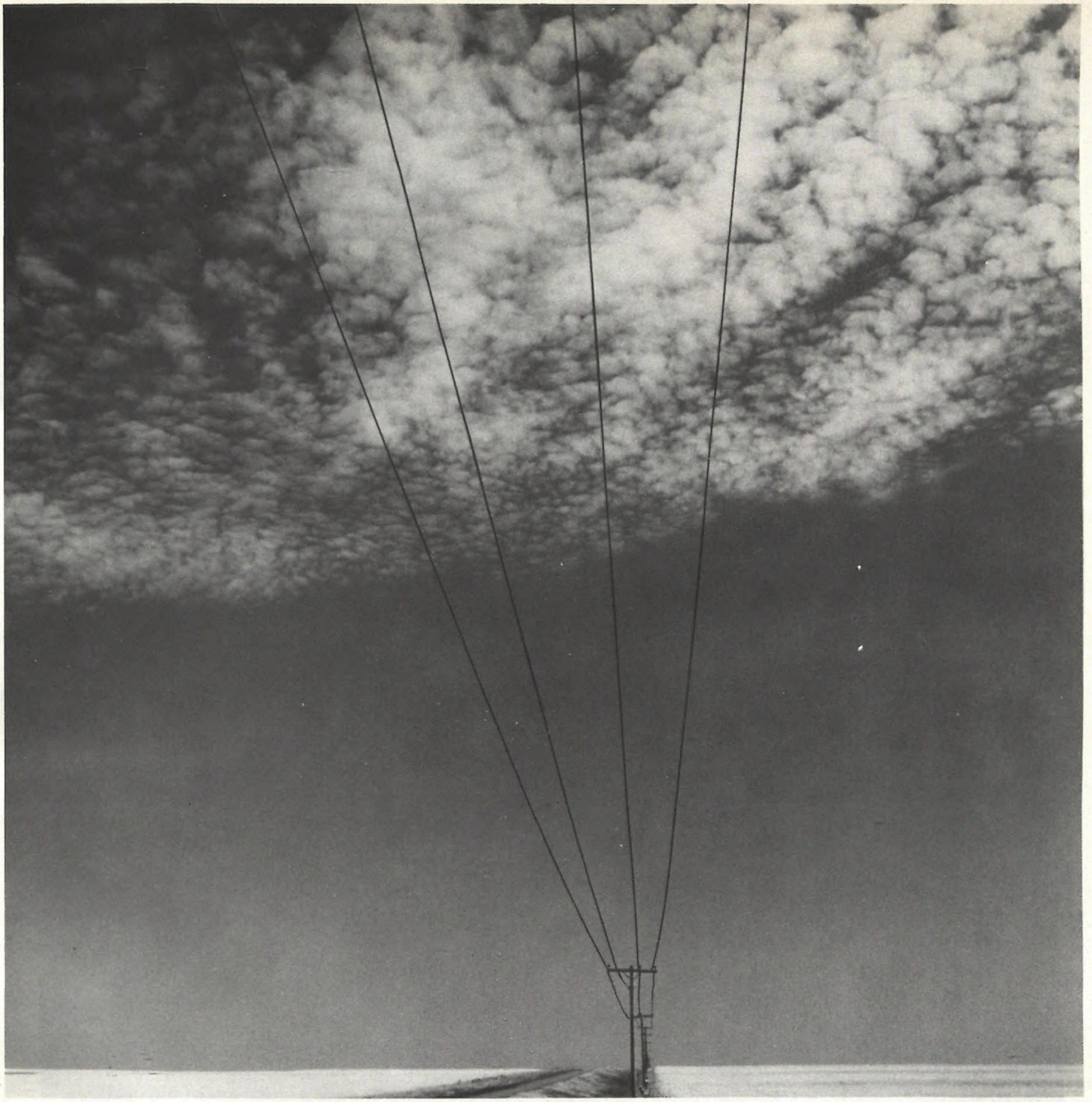

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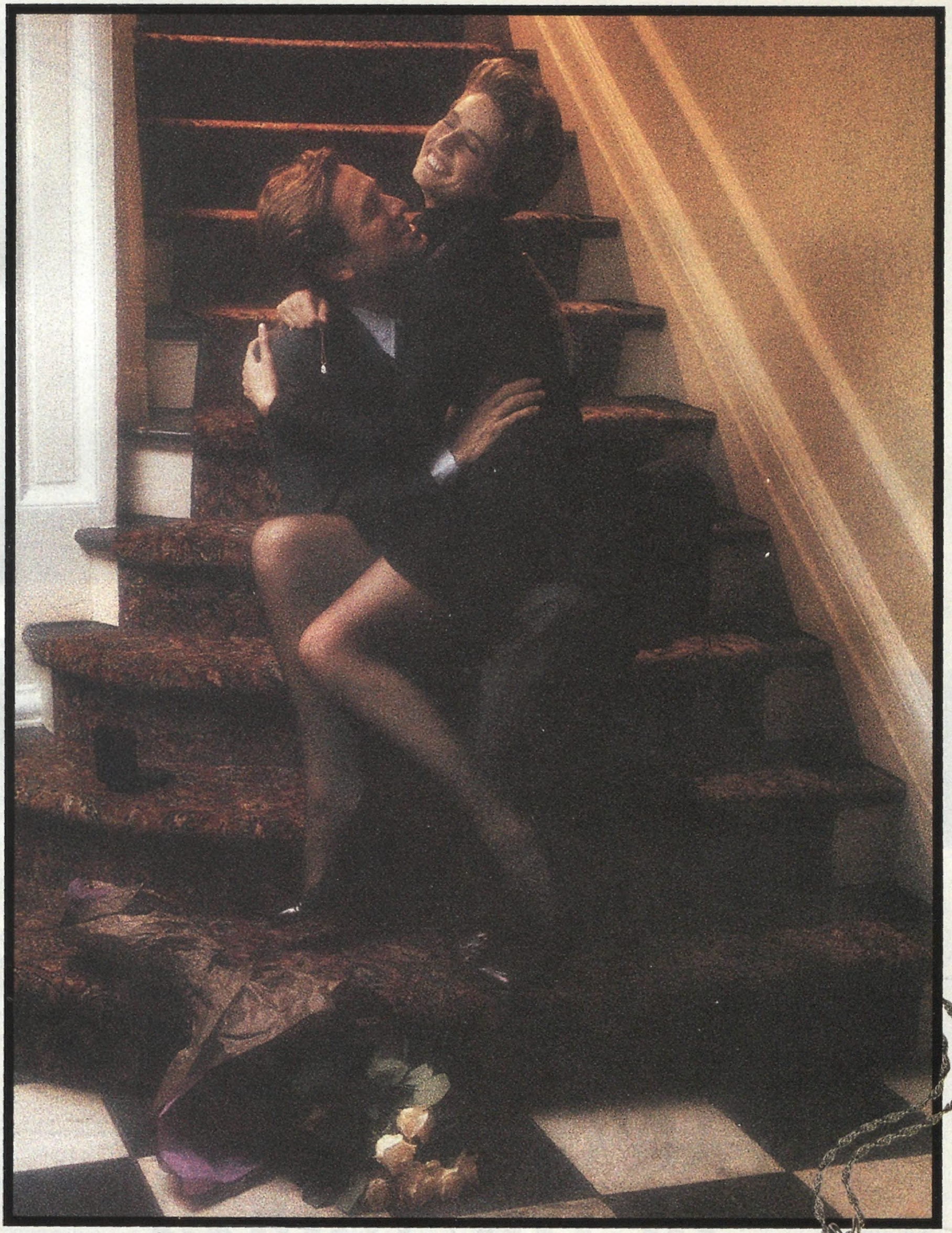

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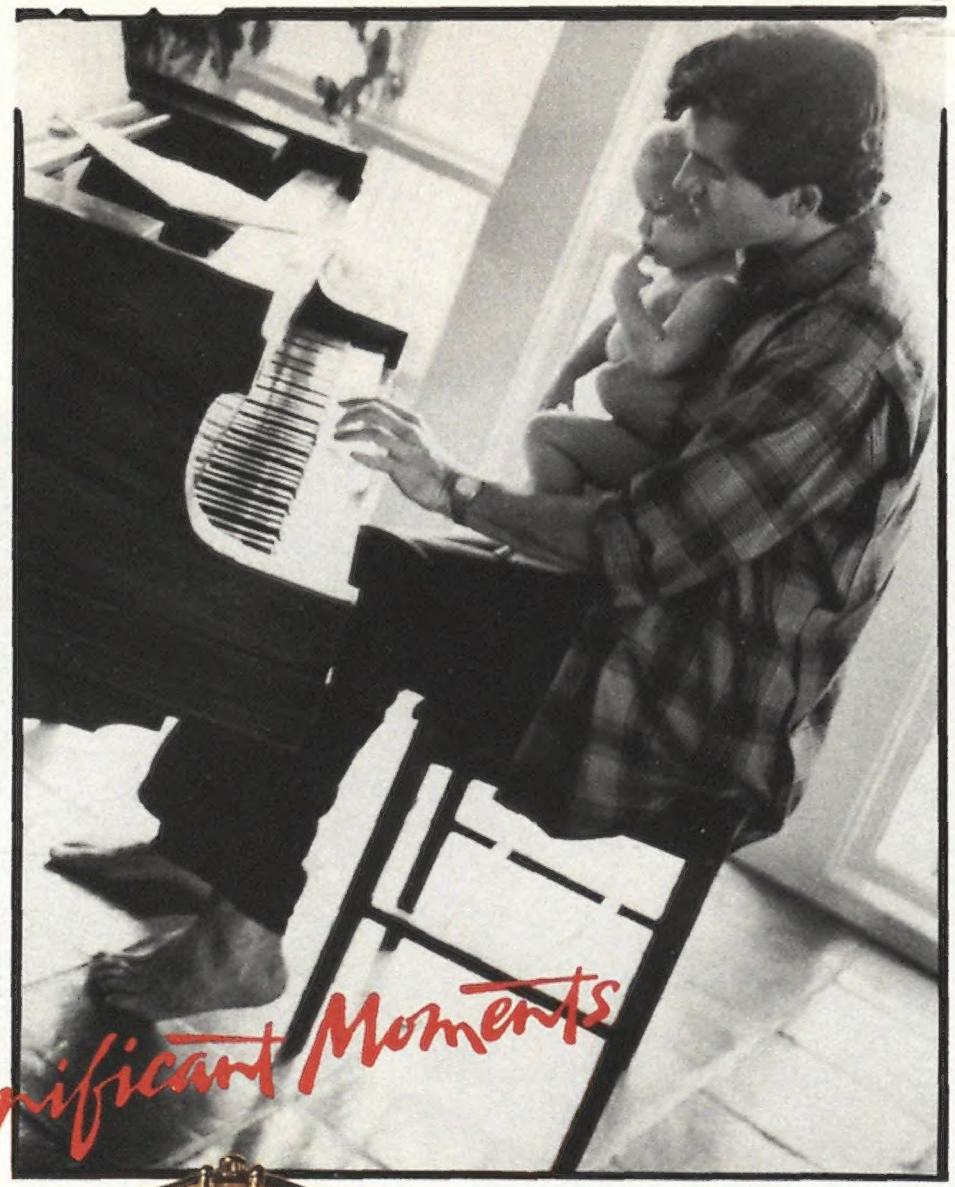

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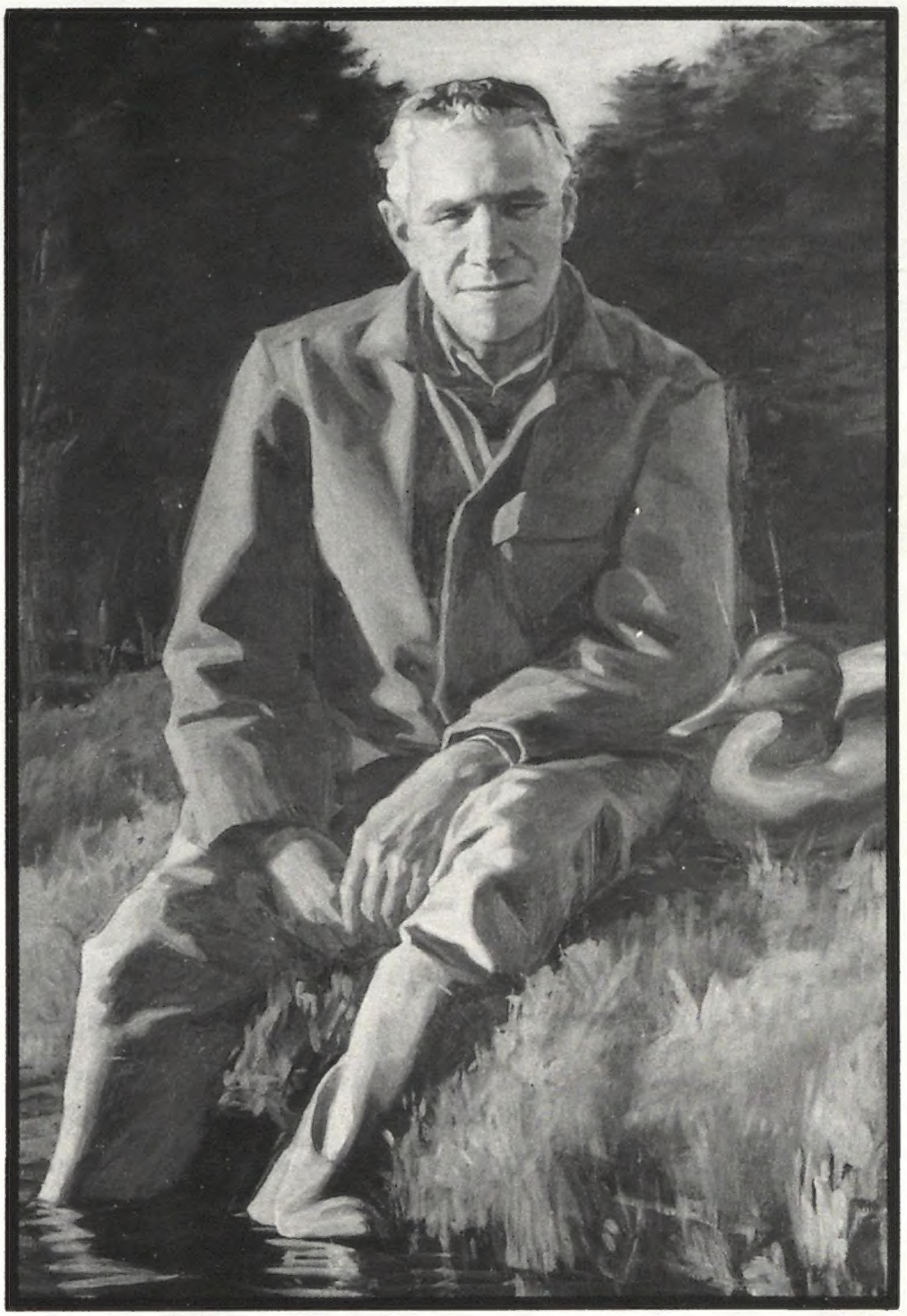

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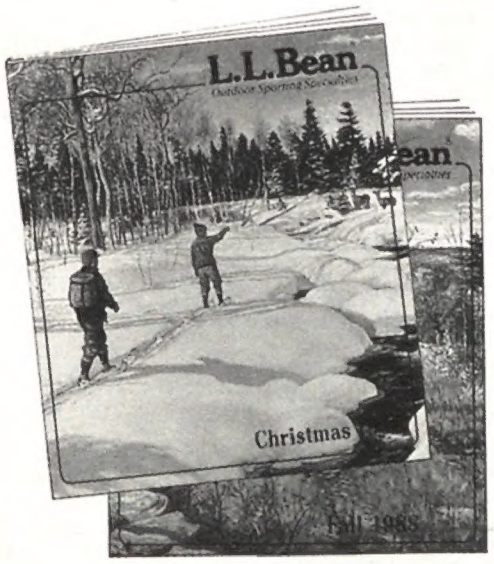

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Smithsonian horizons

Even as the Presidential campaigns address the needs of education, new ideas are needed from every quarter

It is a political truism that complex, long-term issues tend to be neglected or obscured rather than clarified in the heat of general elections. Nevertheless, serious attention to education is to be hoped for in the campaigns now getting under way. With critical issues in abundance among which we must choose wisely, a vigorous debate on the needs of our primary and secondary educational system would serve this country well.

The goal of improved education needs no defense. But in breaking the mold of complacency, we might begin with the threat that declining economic competitiveness poses to our future well-being as a nation. This country's weakening technological leadership and disappointing recent gains in productivity are beyond dispute. It is hard to imagine any set of corrective steps that would not have as a central element a substantial strengthening of our entire educational system.

Parts of what passes for our present "system" have long been excellent, and continue to advance their standards of training and inspiring young people. That is evident to all of us who have been privileged to interact with National Merit Scholars or winners of the Westinghouse Science Talent Search. But there is also no doubt that the circle of secondary schools from which these wonderfully promising individuals come is a fairly restricted one. And at least as important as our need to encourage such outstanding students is the need to raise the average levels of literacy that otherwise will inhibit the potential of our future working population at large.

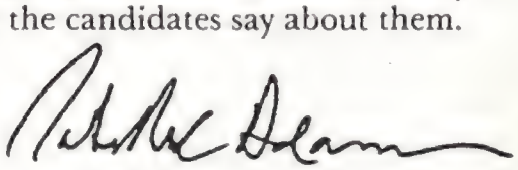
While possibilities of increased funding are at the root of most improvements, the range of additional sources from which such funding might come may be almost as important. The tradition of relying on states and localities, both to design school programs and to provide the bulk of the funds for them, has had much in its favor. But the challenges we now face will be increasingly difficult to meet without an enhanced federal role. Forecasts of formal requirements for a more adequately educated work force, for example, can only be national in scope.

Detracting from the possibility of easy consensus on education at the state or local level is the absence of a close relationship between their present expenditures and future benefits that will accrue to the same districts. The narrow and fairly rigid base of property taxes on which the funding of schools usually depends provides a further constraint. No matter how compelling the need, therefore, the response of state and local authorities is likely to be cautious and incremental at best. Reinforcing other trends toward widening gaps within our society, exclusive dependence on this form of funding may add a dangerous and deplorable element of deepening educational inequities.

How do we cope with the dismaying failure of precisely those elements of our educational system that confront the greatest need—in impoverished urban areas with multicultural differences, a high proportion of non-English-speakers and many symptoms of social breakdown? How can the status and quality of teaching be enhanced in these difficult circumstances? Should we experiment with massive remedial measures, to be quickly invoked as soon as individual or aggregate performance begins to slip? Or are schools by themselves too narrow and vulnerable as institutions to perform effectively in a context of almost all-enveloping social trauma? If so, what other forms of support—directed, for example, at family maintenance—could most effectively be linked with efforts to improve the schools? It is surely important for voters to learn how candidates view this set of looming problems, and what federal contribution they would be prepared to support if elected.

I hope nothing in these remarks is taken to imply that the rest of us can only passively await measures taken by the President and the Congress to address the needs of our school system. There is a need for new ideas and initiatives from every quarter. Among these are museums. Normally thought of only as informally supplementing traditional classroom instruction, they have an unrecognized potential for sometimes providing a superior alternative. We at the Smithsonian have long maintained educational programs in association with our collections and exhibits. Our Resident Associates Program, meeting a seemingly insatiable demand of school groups through its Discovery Theater, has found its performances an effective as well as popular educational medium. More recently, taking cognizance of the disturbingly wide gap between currently prevailing standards of mathematics and science instruction in many schools, and the demands of the new Information Age into which we are moving, we have established a National Science Resources Center in collaboration with the National Academy of Sciences. It is developing a set of elementary science teaching modules and is building networks of districts, schools and individual teachers who will test and improve them.

The need and opportunities are there, in other words. Get involved yourselves, but also listen carefully to what the candidates say about them.



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Letters to the Editor

Boundary Waters Canoe Area

Dear Sir: I laughed aloud as Jim Doherty's July article rekindled memories of a nine-day trip my husband and I took, with an outfitter, out of Grand Marais in the summer of 1982.

We were guaranteed it was for novices, all still waters. To one who had never even sat in a canoe, the trip proved a "totally awesome experience." The word "portage" took on new meaning, as did "mosquito." I quoted the outfitter's ad to him: "Be prepared to extend yourself on occasion," saying, "Peter, you lied! I never worked so hard in my life." He answered, "If we had told the truth, would you have come?"

But the beauty, the solitude, the sunsets, the stillness, the northern lights, the dips in the lakes, the refreshing of the soul, have to be experienced. I loved every moment and would recommend that everyone try it, at least once.

Roberta Wallach
Brooklyn

Dear Sir: The proper job of Doherty's wife, as leader, was to walk in front of the canoe-carrier so he could follow her heels. Not to say she couldn't be toting the pack, too. Advance notice from the heels that a turn is imminent allows for gradually swinging the canoe, an easy matter. Sudden notice requires vicious exertion to swing and then to stop again.

Arthur E. Brown
Miami

Dear Sir: I took a weeklong canoe trip in the boundary waters with my dad, my 9-year-old brother and a guide.

The BWCA wasn't as bad as Jim Doherty said. Our guide and Dad

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showed us how to read the maps so we would stay on the smaller, calmer lakes and have short portages. Our longest portage was only one-half mile and our shortest was merely 66 feet. I carried a 75-pound canoe over the shorter portages (I'm an 11-year-old boy) and never ran into a tree like Doherty. The trick is to watch the trail. I also carried 30-pound packs. They were made so one can be carried on your back and one in front, kind of like a sandwich and you are in between. It wasn't all hard work. It was fun. I'd like to go back.
Ryan D. Allen
North St. Paul, Minnesota

Dear Sir: As annual pilgrims to the BWCA, my husband and I have found that an inverted canoe is a crowded haven for mosquitoes, if the day happens to be rainy.
Pat Bell
Eden Prairie, Minnesota

Dear Sir: I was introduced to "The Quetico" in 1949. Over the years I've watched as the BWCA declined in purity and escalated in popularity. Today *anybody* can take a canoe trip in that area with the addition of tows and modern equipment. Ah, back in those "good old days" . . . But if you don't know how it was, you don't decry how it is!
James Ploss
Glendale, California

Jubal Early

Dear Sir: I have often heard my grandmother tell about Early's men passing through Silver Spring, Maryland. The fort was built on land confiscated from my Beall relatives, and the story goes that the Army tore down their house because it could have protected Rebel sharpshooters. The Union cemetery that Lewis makes much of was also part of the same family farm.
James D. Sorensen
Silver Spring

Dear Sir: There is also a gravesite and monument for Confederate casualties of the Battle of Fort Stevens. North of the Union site on Georgia Avenue in Silver Spring, 17 unknown men from Early's command lie beneath a gray stone obelisk in the cemetery of Grace Episcopal Church. Old Grace Church, destroyed by fire and replaced since the battle, served as a hospital for South-

ern wounded. Those who succumbed to their injuries were interred on its grounds. In gratitude for having been allowed to use the church, General Early gave $100 toward the chapel roof.
David J. Lockwood
Silver Spring

Dear Sir: Unreconstructed Confederates such as myself don't feel that Early's failure to take Washington and subsequent retreat led his men "away from legend and glory." The accomplishments of the Confederate soldiers, their bravery, and adherence to duty in the face of such hardships and obstacles were enough to secure all of them their place in the legends of this country, and to cover them with glory as long as this nation values brave men with stout hearts who will fight for their beliefs.
Robert S. Murphree
Jackson, Mississippi

Dear Sir: John Burroughs, the writer-naturalist, 27 at the time of the defense of Fort Stevens, was employed by the U.S. Currency Bureau. One night, eluding the pickets, he made his way to the front. He wrote Walt Whitman: ". . . during the siege of Washington [I] lay in the rifle pits with the soldiers. I got quite a taste of war and learned the song of those modern minstrels—the minnie bullets—by heart." [Minié bullets were 19th-century rifle balls named for their inventor, Claude Etienne Minié.]
Raymond Lee Zager
Los Angeles

Lightning

Dear Sir: May I add two more to Jack Fincher's list of places to avoid?

Craggy peaks that are much above the surrounding area. I recall especially the peaks of Mount Thielsen and Mount McLoughlin in southern Oregon, where every point of rock within a few yards of the summits had been glazed over by lightning.

In a hiker's refuge cabin, a stove with a metal flue that extends through the roof, and which may also rest on a rock or concrete base, is a perfect lightning rod. With three friends, I once took refuge during a storm in such a cabin on Mount Hood. We reasoned that lightning would strike the surrounding trees and not the cabin, and built a fire in the stove. Ralph Mason reached out a hand to test its warmth and received a terrific

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shock. A great spark had given him a small fraction of the force of lightning that had struck the stove. It was a very narrow escape.
Kenneth N. Phillips
Portland, Oregon

Mississippi kites

Dear Sir: Speaking of comebacks, Iowa's kestrel population was decreasing because their ideal nesting sites, hollowed-out trees, were becoming rare. So, in 1983, state agencies, private individuals and organizations began erecting nesting boxes on Interstate highway signposts. The birds now nest and raise their young in those boxes, and seem oblivious to the traffic. Roadsides and nearby grasslands provide the kestrels' diet of insects and rodents. Wildlife biologists speculate that one benefit of signpost nesting boxes is the steel posts: they thwart predators that could destroy nests or young birds.
Mary Jean Timp
Iowa Department of Transportation
Ames

Charles Kettering

Dear Sir: Mr. Bernstein, in his mention of air-cooled automobiles, neglected the Franklin. It may not meet mass-production standards, but thousands were built and ran successfully for years. My father owned several, and I can still recall how silently the engine started when the ignition key was turned.
George G. Huntoon
Naples, Florida
As Mr. Huntoon surmises, the air-cooled Franklin was not manufactured in sufficient quantity to qualify as a mass-produced automobile. Ed.

Dear Sir: Rather than "saving the American consumer billions of dollars," Kettering's role in promoting the use of tetraethyl lead, over the concerns of the public health community, helped pave the way for a major environmental health disaster of this century. Sixty years of lead in gasoline has left a legacy of poison in our air, food, soil—and in our bodies.

Not for 50 years did the proponents of public health begin to turn the tide, when the Environmental Protection Agency began restricting the use of lead in gasoline, at first to protect the catalytic converter and finally to protect human health. The impact of this long-delayed action is shown in the dramatic decreases in Americans' blood lead levels, which exactly parallel reductions in use of lead in gasoline.
Ellen K. Silbergeld, PhD
Director, Toxic Chemicals Program
Environmental Defense Fund
Washington, D.C.

Dear Sir: In the late 1950s Mr. Kettering, guest of honor at an Antioch College Alumni Association dinner, was presented with a formal award. But since the Boss usually referred to himself as a "pliers and screwdriver man," one of our group got the idea of buying miniature pliers and screwdriver (actually, jeweler's tools) and having them encased in clear plastic, on which an appropriate legend was engraved. When I, as president, presented them, the Boss took one look at the gift and announced, "Just like an educational institution, they give you tools you can't use!" The house came down!
Milton C. Wasby
Belmont, Massachusetts

Dear Sir: Your article evoked memories of the sometimes exquisite injuries inflicted on various parts of one's anatomy by the capricious automobile crank. It also brought to mind an adage of that era, frequently directed at teenagers: "Be a self-starter; then your mother won't have to be a crank."
William F. Speerstra
Catawba, Wisconsin

Portrait artists

Dear Sir: There is a classic joke about portraiture: a middle-aged, not especially attractive woman commissions a portrait. At the very first sitting she tells the artist to paint her just as she is: warts, lines, thinning hair . . . Breathing a sigh of relief he picks up his palette, at which point she says, "However . . ." She would like two or three diamond and emerald rings painted on each of her hands, a large diamond bracelet on her left wrist and an equally large aquamarine bracelet on the right. And to top it off, a large diamond tiara. The artist agrees, but overcome with curiosity, asks why. The woman responds, "If I were to die I know that my husband would remarry within one month. I want his second wife to go crazy looking for these things."
Edmund Shimberg
Woodbury, New Jersey

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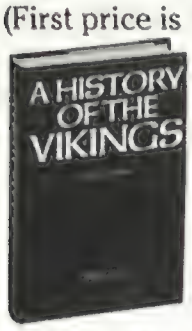

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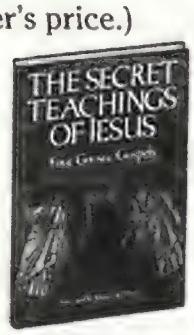

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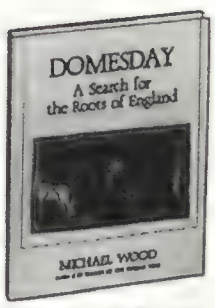

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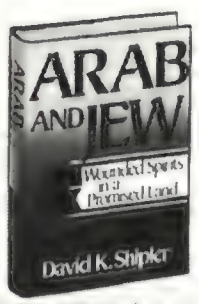

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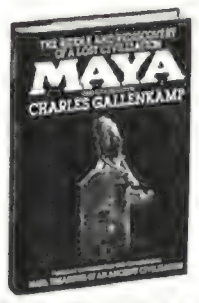

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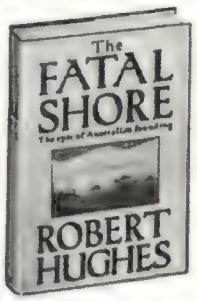

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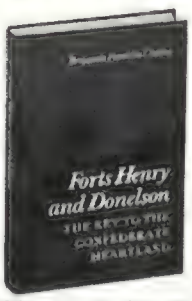

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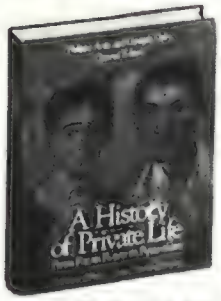

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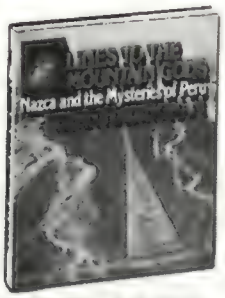

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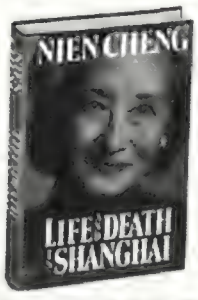

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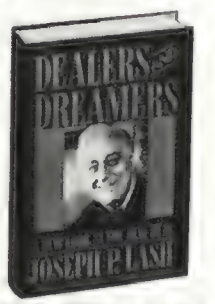

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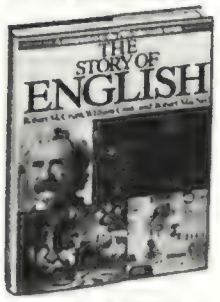

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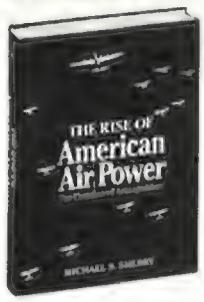

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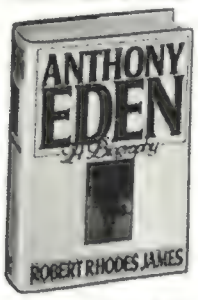

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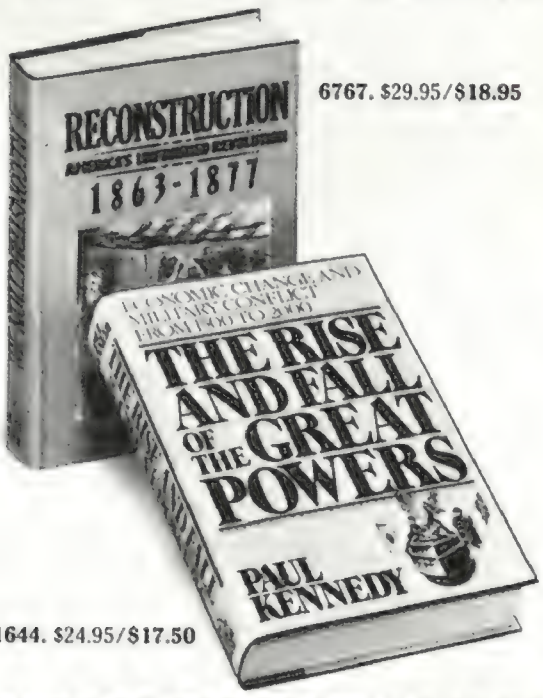

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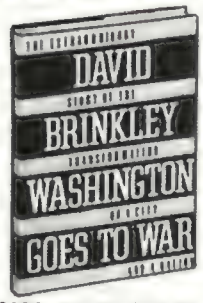

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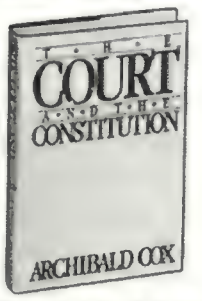

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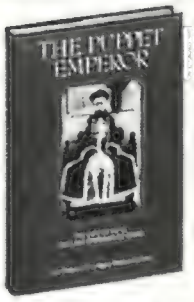

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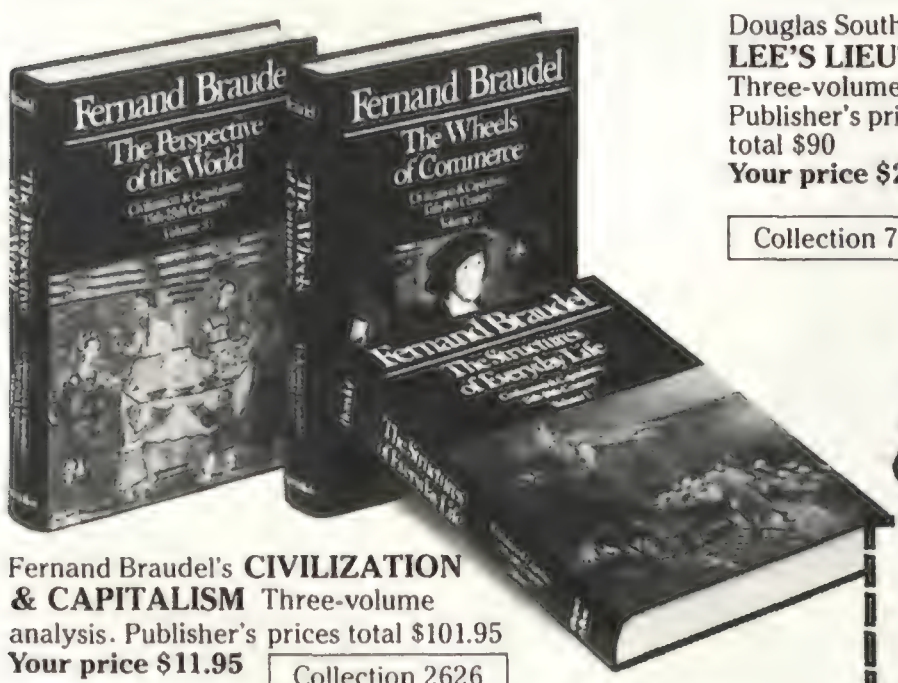

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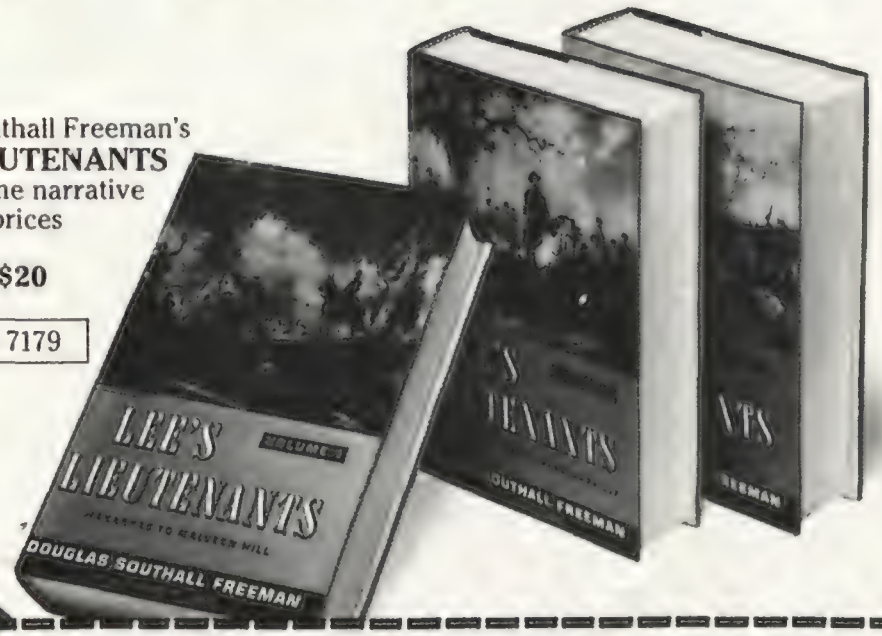

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Around the Mall and beyond

As he usually does, Mike Morgan was driving me around the National Zoo in one of those enlarged golf carts the staff uses—noisy, barely controllable, yet just slightly convenient. We wound through kindergartners and college students, and he shouted at me above the complaints of his vehicle. I heard little until we slowed for a turn onto a wooded pathway. "This is where we'll see them," he yelled over to me.

A group of Zoo-goers lined the side of the path, staring into a patch of tall trees. Ropes, lashed high among the branches, were draped from trunk to trunk. Hands suddenly pointed up into the foliage. Lurching to a stop, we left our little engine to die in peace and joined the crowd.

More pointing, more excited voices: "There! There's one of them!" I made out what looked like a large birdhouse built against a tree trunk, supported by boughs. From it hung an animal's tail. Then the creature turned, and I recognized the small red-maned face, intent and wary, of that beautiful, highly endangered South American monkey, the golden lion tamarin.

"This is what I've been telling you," said Mike. "We impose no restraints. They just wander freely around this part of the Zoo, getting used to living in trees so they can be reintroduced into their native habitat in Brazil."

I knew that since the early 1970s, the National Zoo had joined with Brazil to lead the way in rescuing the little squirrel-size "GLTs," as they're called, from the brink of extinction. I also knew that since 1984, GLTs from this and many other American and European zoos had been reintroduced to preserved remnants of their natural Brazilian forest.

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But this free-release experiment—letting the animals wander around the Zoo and get acquainted with real trees and flexible branches instead of those beautiful fakes in their enclosures—had slipped right past me.

"We started it in 1986," Mike told me. "At first the little guys were extra-cautious about leaving their home nesting box. But after a few months they'd wander over quite a large area of the Zoo. They got so brave that they'd visit the cage behind the Small Mammal House to say hello to the tamarins in there."

Those ropes were strung from the trees to give the animals a way to travel that would resemble the branches and vines (arboreal pathways) of their Brazilian forest. Ropes cross over the busy pedestrian paths (gaps in the forest), "so the GLTs won't endanger themselves by traveling on the ground or cause trouble by jumping into baby carriages and swiping pacifiers," said Mike.

The group of seven that I met had been released two months before and were still pretty timid. But they were beginning to venture away from their nesting box (a 30-quart plastic picnic cooler, chosen because of its excellent thermal properties and light weight) into the big world. By the time you read this, they'll be just about ready to tackle Brazil. By all accounts, the visitors will miss them. The Zoo staff looks on their departure more ambivalently.

"They're such feisty little animals," said one of the FONZ volunteers whose job it is to keep an eye on things and record crowd interest (high). "One female went after a gray squirrel. The squirrel fought back, and the GLT's calls attracted the whole clan, which then banded together to drive the squirrel away. The female was so exhausted that she spent the rest of the day hanging over the entrance to the nesting box."

Nearby, Vania Nunes, a Zoo intern from Brazil, held a radio antenna with which she could track the movements of three GLTs that were wearing collars with transmitters. "They haven't crossed over the visitor walkways yet," she said. "But we remember how bold they get later on. They go all over the place. They'll probably visit the panda yard, like last year's group."

Family life is important for GLTs. Adult pairs bond for life. In the current family, Rufus is the father and Emily the mother. They produced their first pair of infants—usually the young are twins—and according to GLT habits, those twins stayed in the family group through the rearing of several younger siblings.

"If the first offspring are removed before they have siblings," said Mike, "they don't learn how to be parents. But though GLTs help take care of their younger brothers and sisters [they're sort of brought up to be baby-sitters], after a while conflicts begin to arise between mother and daughter and father and son. Thus the older siblings are in time forced to leave the nest."

Rufus and Emily's oldest daughter was Kuff. She stayed with the family to learn parenting when the next babies were born; then she didn't want to leave.

Emily, however, was adamant. Their voices rose in shrieks of conflict, and fighting and chasing ensued—adolescent daughter versus mother. "It was just too much for Rufus," said Mike. He followed mother and daughter as they fought, became disoriented, got lost and spent the night out.

"ON THE VERANDA"

Don't get stuck in Hawaii.

Golden lion tamarins have drawn enthusiastic crowds to their special free-release exhibit at the National Zoo. Group goes to Brazil this fall.

Emily—and the GLT way of life—won in the end. Out Kuff went, only to try once again to return—an attempt that prompted the intervention of the Zoo. She was trapped and taken to a holding area to await pairing with a young male. She's still waiting. Oh well, no one ever promised her a rose garden.

New siblings arrived: Niko, Mariah, Opie, Petie, Sandy . . . I think that's all, but I'm pretty bewildered. Somehow they all packed into that nest house and apparently got along just fine even during one of D.C.'s worst-ever hot spells.

When this turbulent family ships out to Brazil this fall its members will have a strong advantage over the first 13 Zoo-bred—and Zoo-trained—GLTs released there in 1984. Benjamin B. Beck, assistant director for animal exhibits at the National Zoo, points out that there's as much difference between training in the cage and entering the real forest as there is between flying a flight simulator and getting into the cockpit of an airplane. "What's more," Beck says, "it was expensive, time-consuming and labor-intensive."

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food, prodding around for it with their capable fingers instead of having it served up regularly on a plate. They learned to be wary of stinging insects and to avoid predators. Yet despite all that rehearsing, when they reached their patch of Brazilian forest they didn't want to leave their cages. After all, that was a jungle out there!

"Their reluctance to venture out," says Beck, "was one of the things that suggested trying free release on the grounds of the Zoo."

So the Zoo people tried the experiment with a 1986 group of GLTs. The animals were immobilized, fitted with tiny radio transmitters and given individual markings to make life easier for their human monitors. Then, still in the cage nesting box they'd always known, they were placed in the trees. "And when they woke up," Beck recalls, "they were in our own little 'forest.'"

They stayed in the box for a day, just poking their noses out. They seemed to like their new view of the Zoo, and on the second day they promptly took off in all directions. Thanks to the radio transmitters, the GLT-watchers rounded them up and got them back to their home box. From then on, they stayed put, basing their wanderings on the box, always returning to it.

Ropes were strung to get them used to jungle branches and vines. They cross them like squirrels once they learn how. At first, as I learned, they couldn't cope with the flex and bounce of live branches. They also didn't know how to peel a banana. "They were used to having it cut up for them," says Beck. "Now we hoist real bananas into the trees with pulleys, and let the animals find and eat them. In 1987, we tried the same free-release training in Brazil with some GLTs from another zoo that were about to be reintroduced into their native habitat. They did well. Obviously, the technique works, and it's cost-effective as well."

Apparently the GLTs can get pretty cocky about their freedom. My old friend Billie Hamlet, who works with Mike in the Zoo's public affairs office, told me that one sightseer, spotting the GLTs in a tree, put her handbag down so she could snap a picture. What she didn't see through her viewfinder was one daring tamarin who crawled into the bag, rummaged amid Kleenex, keys and lipstick, then scurried away before she turned around.

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A day spent reading old newspapers sparks a vision of the Atlantic coast on its way to becoming a dead zone

One of the fastest ways for a compulsive reader to get into hot water is to refuse to throw out old newspapers on the grounds he has not read them yet. Venial sins, like reading the cereal box at breakfast instead of participating in conversation, are quickly forgotten if not forgiven. A month of newspapers, stacked precariously on a kitchen counter, becomes a serious offense. Piles of older papers blocking traffic paths in the basement can lead to open hostility.

So on a Saturday when everyone was away and the temperature outside was on its way to passing 100 degrees with several to spare, I cleared off the dining room table, brought in the first pile and went to work. Hog heaven is the technical term for my state when I confront a pile of newspapers and a free day. The hardest part is not deciding what to clip, but what to leave. It is amazing how significant a story can appear when you have time to appreciate it, instead of racing through the paper in the weekday morning rush.

With a clipper, scissors and a straightedge, I plunge in. Something leaps out from almost every news section. In no time at all I have a fat folder full of miscellaneous intelligence, stories I want in my own primitive data base for some unidentified future use.

Some clippings are of conflicts I want to follow: a suburban Maryland couple who have turned what was their lawn into a meadow, running afoul of neighbors and the county authorities; Congressional efforts to impose some mini-

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mal safety standards on the nation's commercial fishermen, the most dangerous (and unregulated) occupation in the country; and outrage in England and West Africa at plans to dump millions of tons of American waste there.

Other stories are encouraging follow-ups to articles we have run in SMITHSONIAN: the birth of pups to red wolves reintroduced this year into North Carolina (March 1988) or a meeting in Brazil on ways to cut hardwoods without destroying the Amazon rain forest, a development that could ease the pressures on the preserves that are now being worked out by scientists (April 1988).

One (perhaps the only) advantage of going through newspapers 50 pounds at a time is the chance to see patterns that might be missed from one day to the next. For example, no newspaper reader in my part of the country is unaware that Chesapeake Bay is in trouble. Harvests of oysters are way down, and the rockfish (striped bass) population dropped so low that Maryland imposed a moratorium on catching them. But there is a larger picture that is equally distressing, one that is harder to see unless you read the stories all at once. Here are just a few clips from that dining room table:

In southwest Florida, the number of young tarpon has dropped precipitously. A state team checked 40 places in the Florida Keys where young of the popular game fish have always been found: tarpon were present in only five. Nobody knows if the drop is part of some natural cycle or an unnatural catastrophe. Russell Nelson of the Florida Marine Fisheries Commission is quoted: "The evidence leads us to suspect we have a problem with the tarpon, but in the absence of any funding for real research, it remains a puzzle."

In Albemarle-Pamlico Sound, the protected waters inside the Outer Banks of North Carolina, commercial fishermen are worried. First a fungal disease ate holes in crabs' shells and left gaping sores in the sides of fish. Then last year a brown tide—a bloom of toxic algae—hit the sound, forcing the closing of a hundred miles in the middle of the scallop and oyster season. Indigenous, nontoxic algae so deoxygenated the water that eels, crabs and even fish were crawling out on the banks because they could not breathe in the water. This year the fungal disease is back.

On to the next pile of papers. In New Jersey last June, one story says, tens of thousands of dead eels, flounder, bass, crabs and shrimp washed up on a beach inside Sandy Hook. State officials called the kill natural, the result of high temperatures and calm weather that left the water low in oxygen. Federal officials were less certain, however, because of the variety of species and sizes of the fish that died. By July the oxygen level in Long Island Sound was dropping toward the 1987 levels that killed lobsters and fish, and a brown tide had appeared in Long Island's Great South Bay.

Offshore the news is just as bad. Fishermen from Point Judith, Rhode Island, reported in May that the lobster catch from canyons along the continental shelf had dropped 70 percent in a little over a year, and of those that were caught, many were unsalable victims of "burn-spot" disease, holes in their shells eaten out by bacteria. Catches of tile fish, butterfish and squid have dropped at least 50 percent. All this has hap-

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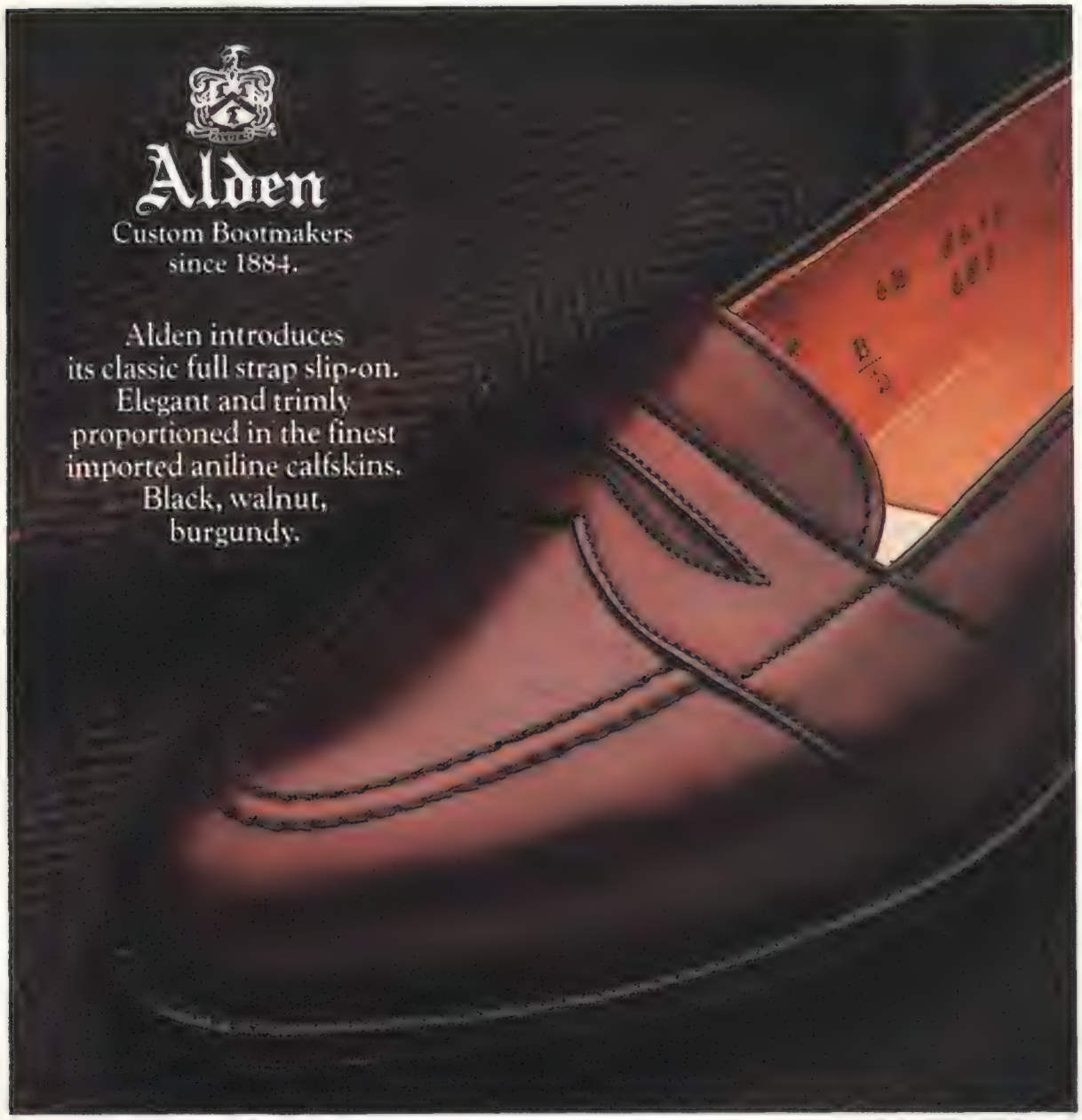
Rhode Island lobstermen say catches are down in continental shelf canyons.

pened since New York City and a number of New York and New Jersey municipalities began dumping their sewage sludge in 6,000 feet of water at the 106-Mile Site, so named because of its distance due east of Cape May, New Jersey. Until 1987, they had been dumping it in 80 feet of water just 12 miles off Sandy Hook, an area that has long been a "dead zone." The fishermen claim that some of the sewage vessels dump their loads before they get to 106-Mile, especially in bad weather, and that even the sludge properly dumped gets carried back up into the shelf canyons by eddies from the Gulf Stream. (Nine municipalities were threatened with fines totaling $1.25 million in April for dumping too much in one place, but none was accused of dumping short of the site.) Both the National Marine Fisheries Service and the Environmental Protection Agency (EPA) said there is no evidence that the dumping has anything to do with burned lobsters and the lack of fish, but the EPA is monitoring the area. (One solution has been around for 50 years: at the garden shop, I pay $8.99 for a 40-pound bag of Milwaukee sludge. The lawn loves it.)

These stories were clipped in late July, and until then there had been no repetition of the 200 dead porpoises that washed ashore the year before. More syringes, blood vials and other



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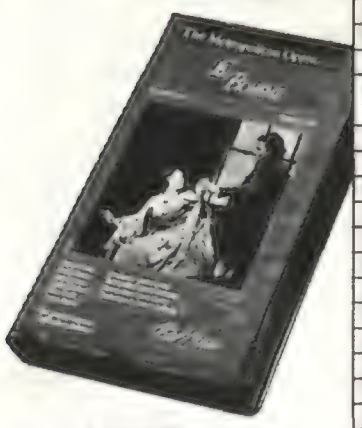

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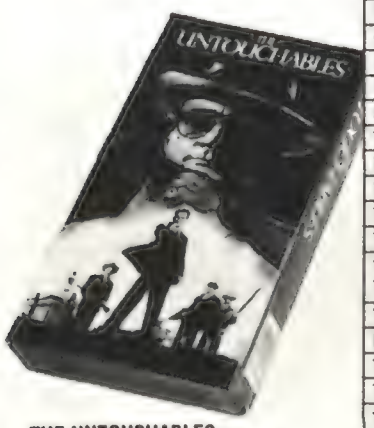

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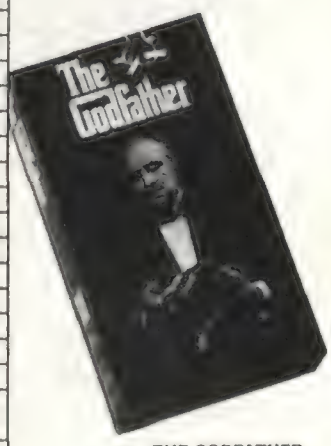

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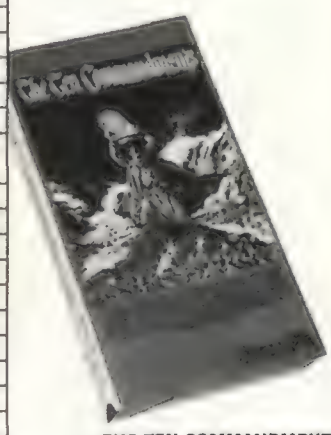

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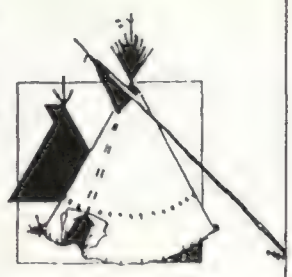

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hospital wastes were washing up on the beaches of New Jersey and Long Island, but that seemed a local problem.

Two general stories hung like a cloud bank over the rest, however. They concerned phenomena we have all read more than enough about, but which I, for one, had never applied to the oceans. The first said the Environmental Defense Fund had found that acid rain is doing direct damage to coastal waters. The nitrogen compounds involved are key nutrients leading to the algal blooms that deoxygenate the water and kill everything in it. The second pointed out that a depleted ozone layer and the increased "hard" ultraviolet radiation that comes with it could have a disastrous effect on marine phytoplankton, the microscopic plants that live in the surface layer of the oceans. Working in Antarctica, where ozone depletion is the most serious so far, Sayed Z. El-Sayed of Texas A&M University has found that any increase in ultraviolet radiation substantially decreases photosynthesis in the phytoplankton. This in turn would affect the krill and the entire food web that depends on them.

There's more, lots more, and two big piles of papers in the basement still to go through. But the pattern is clear enough now, clearer perhaps for having read all these stories in one day instead of one at a time. Sitting at that table, fingers and elbows stained with ink, I saw the entire Atlantic shore like some magical museum diorama. The beaches were as beautiful as ever, the breezes just as fresh. But in the water, fish and shellfish were dying, and brown tides formed great, spreading stains. It was ugly, and led to further, frightening visions of the future.

The experts cannot yet say for sure exactly what is causing what. But the overall picture is there for a compulsive reader. Our coastal waters have taken all they can take and they're not going to take any more. Or, as one scientist put it, "We are exceeding the assimilative capacity of some of our coastal embayments."

The work that scientists are doing and will do is necessary but not sufficient. We do need to understand exactly what is happening, how it all works. But we already know, in a general way, what is going on. We have been treating the ocean as a waste tank and now, mirabile dictu, it is becoming one. We need to get angry enough to stop.

John P. Wiley jr.

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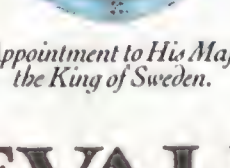

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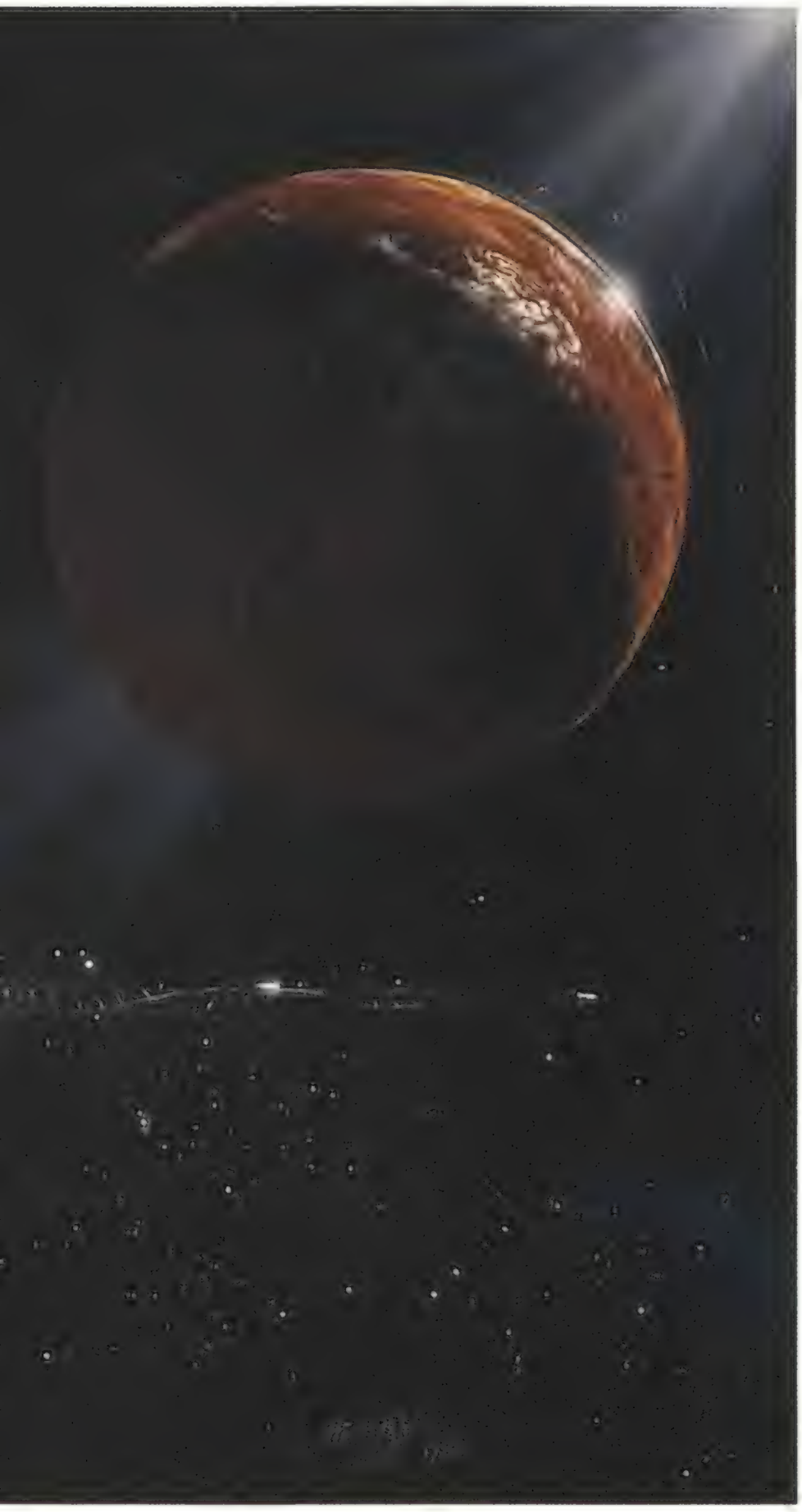
By James R. Chiles

Flying on a wing and a prayer, Voyager heads for a last rendezvous

Launched to visit two planets, the aging spacecraft nears its fourth—Neptune—despite power losses and lapses of memory



If you happen to be outside at 9 o'clock, Pacific daylight time, on the evening of August 24, 1989, look into the Milky Way above the western horizon. The gassy blue-green planet Neptune will be hiding among that spray of stars, too dim to see. Your tax dollars will be at work up there, on board the spacecraft Voyager 2, which will be making its closest approach to the eighth planet at that hour. It will be the final checkpoint on Voyager's four-planet "grand tour" of the outer solar system. After that, eternity beckons.

Voyager 2, a space probe originally designed for only 4 years and two planets, but still going after 11 years and three planets, is the superstar of America's space program. Though it was not launched with equipment for the special demands of Uranus and Neptune encounters, its operators have reeducated it from the ground to do the job anyway. On occasion, electronics have fizzled and gears have locked, but the controllers have been able to make repairs by remote control. Along with sistership Voyager 1, it has a good chance of surviving to make measurements beyond the solar magnetic field and into true interstellar space.

If the Voyagers have the inelegant but functional look of something designed by a committee, it's no accident. The two probes were built, and are operated, strictly by scientific consensus. More than 200 scientists and engineers work to keep them productive, and to prepare for Voyager 2's swing by Neptune and its moon Triton. No order goes off into space without hours of meetings conducted in Voyager shorthand. I sat in on a February session held to vote final approval for a transmission and tried to pursue the discussion through phrases like "command loss disable" and "flash-off heaters." One exchange between a couple of shirt-sleeved scientists went like this:

"Cruise Five?"

"Well, E-601, I think."

Most Voyager people can be found in an eight-story building labeled 264 at the Jet Propulsion Laboratory in Southern California. JPL runs Voyager and the Deep Space Network of antennas needed to communicate with it, as a contractor for NASA. Still more Voyager people are faculty members at universities scattered around the country; they're responsible for using the spacecraft instruments to best advantage.

JPL, run by the California Institute of Technology (SMITHSONIAN, September 1987), occupies a campuslike complex of buildings on the lower slopes of the dusty San Gabriel Mountains. Here, in 1936, Theodore von Kármán, a Caltech scientist, started testing rockets from

Artist's portrait of flyby shows Voyager with Neptune behind it, after a closeup view of the moon Triton.

Color photographs by Chad Slattery

Aging Voyager approaches Neptune

At JPL, two navigation operators analyze image sent by Voyager in May, with Neptune as a faint white dot.

a dry riverbed. Kármán's work led to the laboratory, and eventually to JPL-managed Ranger and Surveyor trips to the Moon, as well as Viking missions to Mars, and Mariner trips to Mercury, Venus and Mars. As the list suggests, JPL specializes in unmanned probes. Currently it's preparing 1989 launches of the Magellan spacecraft to Venus, and the Galileo probe to Jupiter.

The professor's memory also lives on in the lab's Von Kármán Auditorium. On prominent display is a full-scale model of Voyager. JPL has good reason to be proud of Voyagers 1 and 2, which revealed the molten-sulfur volcanoes of Jupiter's moon Io and the tortured landscape of the Uranian moon Miranda. Their photographs of Jupiter's titanic storms appear on classroom walls around the country. They reported on Saturn's strange ring structures, such as braided rings and dark spokes, that sent planetary scientists diving for answers.

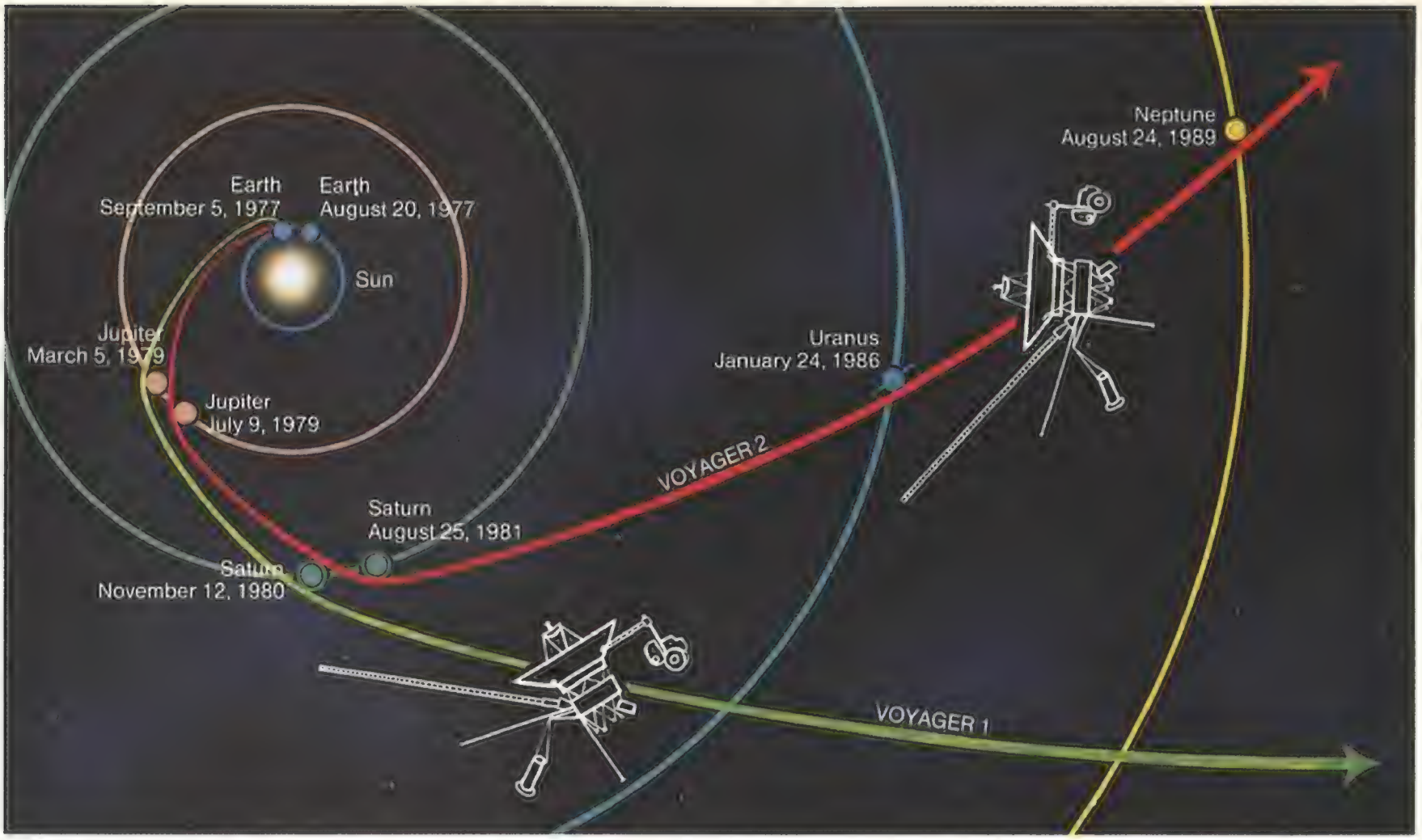
Visualize this white-and-black model on course for Neptune at ten miles per second. Twin whip antennas point forward to tap planetary radio- and plasma-wave signals. A third antenna is a 12-foot dish that points back toward Earth and keeps Voyager in touch with JPL. At the base of this dish is a round tank of hydrazine fuel for maneuvering. Surrounding the tank is a thick, ten-sided ring called the "bus," which is about as big around as a poker table. Its ten bays hold all six computers, the tape recorder, radio gear, gyroscopes and a network of tiny electric heaters that wink on and off to keep the interior temperature slightly above freezing. Outside of bay number six is a gold-coated copper record offering digital-encoded sounds and pictures of Earth to whatever finds it. (Note to aliens: set your player for 16⅔ rpm.)

A power supply with less power each year

Voyager bristles with booms. One is a 43-foot-long tower holding magnetometer instruments; during launch it was stuffed in a bucket something like a jack-in-the-box, then uncanned in orbit by explosive bolts. Another is the instrument boom, which carries the majority of Voyager's 11 scientific packages. Five instruments, including two television cameras, sit on a swiveling scan platform at the end of this boom. The narrow-angle camera would be capable of showing the Empire State Building from Los Angeles were it not for the curvature of the Earth.

On the opposite side of the bus is another boom, holding three plutonium-powered thermoelectrical generators. Every year, decay robs Voyager of about seven watts of output. At Neptune, 12 years out, it won't run everything simultaneously.

Voyager 2 has suffered other bruises at the hands of time. The worst is damage to a gearbox, called an actuator, about the size of a quart jar, which rotates the



Paths of the two Voyager space probes are shown in diagram: Voyager 1 along green arrow, encountering two planets; Voyager 2 along red arrow, making grand tour of four planets, due to pass Neptune next August.

scan platform. Less than two hours after Voyager's closest approach to Saturn in 1981, it locked up completely and caused cameras to gaze off into deep space when moons were on the program.

Intense diagnostic work followed, including tests on 86 mock-up actuators and on Voyager 1 (which made its last encounter in 1980). The explanation: hard use had squeezed the silicone lubricant out of a bearing and friction clamped the gears to a halt. The stuck actuator started working again later, but the incident left metal fragments in the lubricant. Tests indicated that the damaged horizontal actuator had at least a hundred complete turns left before it failed permanently, crippling the scan platform and half of Voyager's instruments.

"We've used about 94 revolutions already," says George Cox, an electrical engineer who specializes in the scan platform. That means that any proposal to use the actuator comes under heavy rationing. Most of the remaining life is being hoarded for Neptune.

One way that JPL tries out the effects of proposed commands on the actuator and other crucial equipment is a sort of exploded Voyager, erected behind a green wall of electronics cabinets on the fifth floor of Building 264. Scan-platform actuators are on hand, along with replicas of the three types of computers that Voyager 2 carries. Voyager carries a pair of each type—main and backup—making a total of six computers. One type issues commands to everything else; one type keeps the spacecraft stable and points the scan platform; and the third digests information from the science experiments. This last type is called the Flight Data system computer, which in the testing room is mounted on three big brown panels sitting on a table. It has the look of a science-fair exhibit.

Like the actuator, the Flight Data system computers on Voyager 2 have their problems; on two occasions they've lost chunks of memory due to age. Still, the backup model works well enough for the imaging scientists to use it to compress information coming from the cameras, to better tap the brief time available for radio transmission. To make this possible, JPL reprogrammed the computers before the Uranus flyby, and again to turn the whole spacecraft enough to track Neptune and Triton. That way the cameras can keep their shutters open for long enough to get good pictures under the feeble sunlight available. How feeble? Go for a walk at sunset on an overcast day: high noon on Neptune is as dim.

Another link in the chain that must hold together for a good Neptune encounter is precise navigation. The problem is that Neptune makes a circuit only once every 165 years. "This planet has not even been observed for one complete orbit since its discovery in the 1840s," says Donald Gray, who heads the Voyager navi-

James Chiles is a frequent contributor to SMITHSONIAN. *He wrote about codebreakers in the June 1987 issue.*

gation team. It means that nobody knows the exact period of its orbit, which means in turn that the navigators aren't sure of the precise moment when Voyager will arrive. Another uncertainty is exactly how much Neptune weighs; this is important, says Gray, because it determines how much Voyager's course will be warped by Neptune's gravity. Navigators are depending on this warp to send Voyager sharply south, after passing Neptune, to bring the craft within camera range of the moon Triton. (Triton's orbit is tilted at a sharp angle to the plane of the solar system and this southerly twist is the only way Voyager can make good studies of the moon on the day of the encounter.) It's crucial to send Voyager through a narrow cone behind Triton, which will block its view of both the Sun and Earth. This "occultation" will supply information impossible to get any other way and may confirm guesses that Triton has lakes of liquid nitrogen.

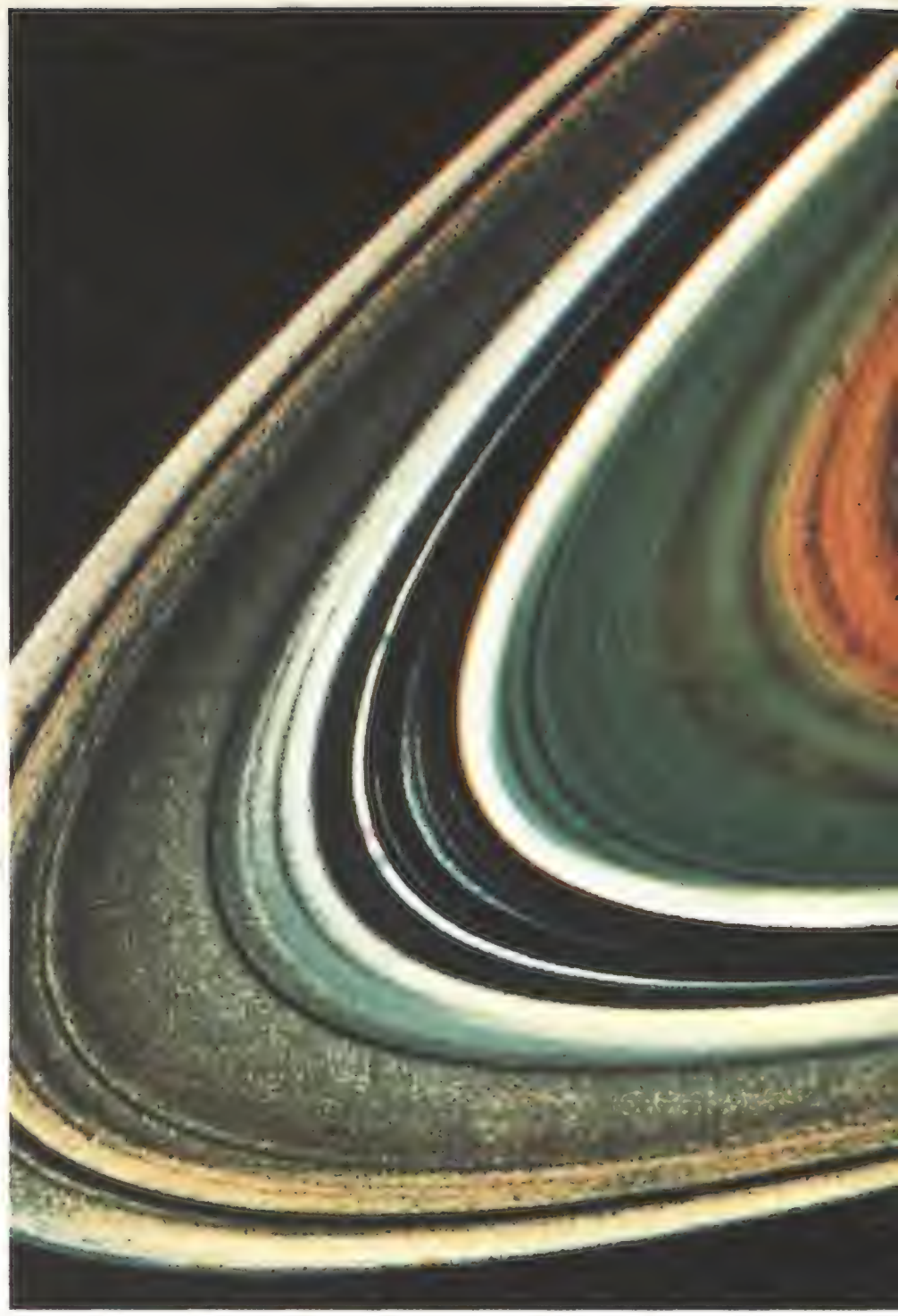
Stealing energy from planets along the way

Using gravity to set Voyager's course is no afterthought. The outer planets have been the hinges to mission success throughout. Without gravity boosts from Jupiter and Saturn, the trip to Neptune would have taken more than 30 years, instead of 12. To explain how Voyager gets that boost would require a pageful of equations and tiny arrows called vectors, but the important point is simple: an outbound spacecraft, if it leaves Jupiter in roughly the same direction that the planet is moving around the Sun, can steal energy from that planet to change course and raise its speed.

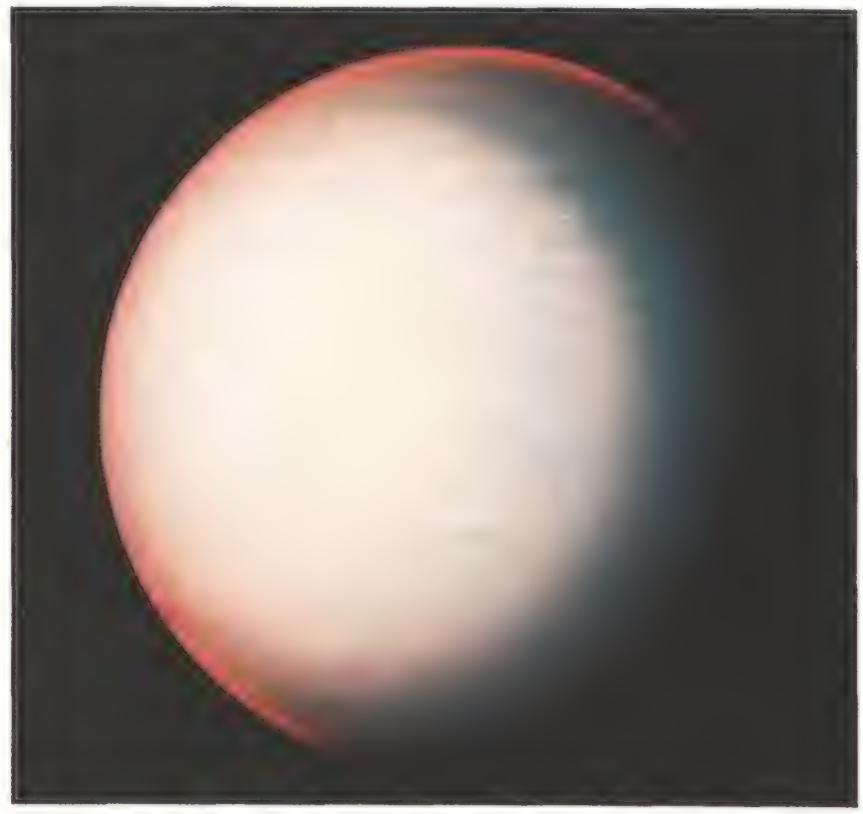
After Voyager 2's pass by Jupiter, Gray says, "there was an energy loss, meaning that the orbit came in slightly." But not very much of a loss—less than the diameter of an atom: during the next 70 billion years, if the Solar System holds up that long, Jupiter will cover one foot less than otherwise.

The navigators are aiming Voyager at a point 2,700 miles above Neptune's north pole. This is much closer than either of the Voyagers has approached a planet before. It is important not to get too close and risk total destruction from the fragmentary rings of pulverized gravel that orbit Neptune, or from electrical damage from its belts of trapped radiation. But pass at too great a distance and Neptune's gravity bend will not be strong enough to send Voyager within good range of Triton.

This increasingly accurate information will be found in photographs coming back from Voyager's cameras. Already, the Optical Navigation group at JPL is studying these pictures, scrutinizing the position of the planet and Triton relative to the starry background. A typical photograph now shows Neptune as a white smudge amid several dozen smaller smudges;



Saturn's rings were photographed in 1981 by Voyager when it was 5.5 million miles away from the planet.



Voyager photographed Uranus in 1986 from 1.7 million miles; blue hue (right) indicates presence of methane.

Colors are not what the eye would see, but a result of computer processing, showing variations in chemistry.

Jupiter, with its largest moon, Io, orbiting in front, was portrayed by Voyager in 1979 from 8 million miles.

most are just blemishes and dust specks, but some are stars useful to the navigation team. Next year they will start looking for Neptunian moons in addition to the two already identified from Earth. The motions of these extra moons will help pin down Neptune's total mass and its exact center.

Meanwhile, up there, Voyager is doing its own navigation. Its principal reference points are the Sun and the star Canopus, an object so useful to JPL that it might be called the lab's patron star. Photosensitive trackers focused on the two stars keep Voyager stable in flight; during each flyby, when a planet eclipses these stars, gyroscopes take over. Voyager is also smart enough to solve some of its own problems. One occupational hazard for spacecraft, for example, is a stuck valve that causes a thruster to keep firing until the hydrazine tanks run dry. Were this to happen to Voyager, it would know enough to shut off the primary fuel plumbing system and shift to a backup set.

A missed call that caused permanent damage

For all its troubleshooting abilities, Voyager is no robot. It needs regular instruction by radio, and here lies a potentially fatal problem. JPL put two radio receivers on board, but only one, the emergency backup set, works now—and not very well. The difficulty started when JPL forgot to call Voyager 2 on schedule in April 1978, before it reached Jupiter; Voyager switched over to the backup because the silence made it think the main receiver had failed. And after Voyager tried to switch back again an electrical jolt knocked out the main receiver permanently. JPL was horrified to find that the backup receiver had another problem: a short circuit in a component called a tracking loop capacitor dropped the surviving receiver's sensitivity from a 200,000-hertz thoroughfare down to a tiny, 200-hertz window.

Not only does JPL have to retune its transmissions minute-to-minute to compensate for the Doppler shift, which changes the frequency of outgoing signals according to the 1,037-mph rotation of Earth; the lab also must retune to correct for the fact that a variation in the receiver's temperature of just one-quarter degree slides the window nearly a hundred hertz down the frequency scale. The firing of the thrusters for a trajectory correction causes so much heating, in fact, that JPL can't send long transmissions at all until two days later. Just turning both cameras on generates enough heat for a one-way radio blackout. The Neptune encounter promises additional radio difficulties. The solutions will push communications with Voyager to new limits of accuracy and complexity. During the close pass by Neptune and Triton, Voyager will have to send information as fast as possible or lose it forever. Every

Engineer Gene Hanover holds mock-up of actuator that rotates Voyager's scan platform, stuck during the Saturn encounter in 1981. Tests on mock-up helped find problem and keep real actuator working for Neptune.

second, the equivalent of two typewritten pages of information will have to squeeze through a transmitter with the total power of five citizens-band radios. This will be the same flow that Voyager managed at Uranus, even though Neptune is half again as far from Earth.

Some of this will be done with fancy computer processing, but it wouldn't be possible without the big ears of the Deep Space Network, which is also managed by JPL. For 30 years now, the network has been talking to spacecraft with huge dishes at tracking stations in Spain, Australia and California. For the Neptune flyby, two of the stations will have the best radio view. One of them is California's Goldstone facility.

It's appropriate to the network's unworldly mission that Goldstone's neighborhood is unpopulated enough to make a hermit sigh for the city lights. It's a three-hour drive from Los Angeles; the last hour crosses the dry lakes and rocky ridges of the Mojave Desert. This part of the Mojave is Fort Irwin, a training ground for the Army's desert-warfare and other battle units; the highway is marked at regular intervals by yellow diamond-shape signs marking tank crossings.

The first sight of Goldstone is a cluster of buildings that serve as the base of operations for the Bendix employees who actually run the equipment. Only one dish is near these buildings; four more working antennas, I am told by Bendix engineer Jerry Crook, are scattered around the neighboring mountains. The largest, called Mars Station, is another 15 miles down the road. Crook explains on the way to Mars that the electronics of 30 years ago required that the antennas be isolated from one another by mountain ridges. Equipment is more discriminating now and antennas can be parked next to one another, but nobody plans to relocate the old ones to cut the commuting time: the rotating part of the Mars antenna alone weighs about 4,000 tons.

When we top a ridge and come into view, the Mars antenna is shrouded by a gantrylike scaffold, giving it the appearance of a mammoth flying saucer in dry-dock. A crane is hoisting white, aluminum panels to a line of workmen on the edge of the dish. Crook explains that Goldstone is widening and tuning up the antenna to make it more sensitive for the Neptune encounter. The Deep Space Network's two other big antennas—at stations near Madrid, Spain, and Canberra, Australia—have already gotten the upgrade and are back in service.

After all the new panels are bolted down, this dish will span 230 feet and cover an area about two-thirds

that of a football field; it will be trying to hear a signal from a 22-watt transmitter, 2.8 billion miles away. Its supercooled amplifier and the receiver will be trying to make out a signal only 12 millionths of a millionth of a millionth of a watt in strength. The feat will require an accuracy of one-eighth inch in dish movement.

Crook leads me through a tunnel and up into the base of the antenna; we emerge onto metal grillwork a few dozen feet off the ground. The dish itself is another hundred feet up and reachable only by a combination of stairs, ladders and catwalks. After some persuasion he agrees to show me the heart of the antenna's transmitter at the center of the dish. "I have not been up here for eight years," he says as we start up, admitting no fondness for the antenna's vertigo-inducing ladders. "Hold on to your hard hat."

The wind kicking off the high desert to the northeast is strong enough to rip pages out of my notebook. I yell a question about it, over the shrieking of wind through the steel trusswork; Crook bellows back that the antenna must be locked down at wind speeds above 60 miles an hour.

A "radio tube" standing eight feet tall

We squirm through hatchways out of the wind and into the calm of a metal-walled chamber called Mod 2. I understand how a mouse would feel while crawling through an old-fashioned radio, for this set uses huge vacuum tubes. Crook explains that the antenna can both receive and transmit. It receives at the tiniest of energies, but it transmits with enormous energy: up to 100 kilowatts for Voyager communications and 400 kilowatts for radar studies of Saturn's rings. He shows me the "radio tube" used for these studies as well as for Voyager communications: it is eight feet high. A radio beam that powerful, Crook tells me, is a positive hazard to anything flying above, whether bird or pilot. Two Goldstone employees are charged with the duty of keeping airplanes out of the way.

Back at JPL, 18 months before the Neptune flyby, I have the opportunity late one night to watch how the whole system works to keep the operators in touch with Voyager 2. The occasion is a pair of regularly scheduled transmissions. Under orders from Voyager Mission Control on the fifth floor of Building 264, the messages will go through the Deep Space Network (in this case, a 230-foot-diameter antenna near Madrid) and on to the spacecraft.

Controller Bill Mogensen arrives a few minutes past midnight one Thursday morning, lets me in and goes off to find some hot water for coffee; it gives me a chance to study the area. The Mission Control booth occupies the middle of a large room furnished with wheeled armchairs and yellow, metal desks topped with a variety of aging computer terminals (at least two of the computer manufacturers have already gone out of business). Dominating the room is a turquoise console, with computer screens and telephones.

Altogether the booth has the funky appearance of a disk jockey's studio. Mogensen, blond and mustached, comfortable in faded jeans and a red sweatshirt with his identification badge hanging from a loose chain around his neck, completes the picture. Mogensen began his career in Air Force telecommunications during

JPL navigator Donald Gray looms over a 1:10 scale model of Voyager, whose trajectory he helps to plan.

JPL engineer Kathryn Weld holds four-page sequence of computer commands for transmission to Voyager; behind her hangs 47-page file of commands, comments and explanations which had to be boiled down to the final transmission sequence, taking 46 minutes to send.

the Vietnam War; he says it was a good way to start training for this job. "There's no place to go to school and get a degree in mission controlling," he notes.

He begins his work at the console with a quick phone call to a fellow JPL employee called the track controller. Working out of a darkened control room in Building 230 across the street, the track controller is Mogensen's link to the big antenna in Spain.

Mogensen wheels his chair over to a computer terminal and types a short string of cryptic numbers and letters. He's preparing to send two messages this morning. The first will take only a few seconds to transmit; it merely says "Hello" to Voyager. If this call isn't made once every few weeks, Voyager will conclude that its radio receiver has failed forever and will fall back on a tiny set of fail-safe computer instructions capable of guiding it through the Neptune encounter.

The second transmission, code-named B814, will take 46 minutes to send. It's a detailed schedule of chores for Voyager 2 to complete during the next two months. Some are housekeeping duties and others tell Voyager to operate those scientific instruments that are useful between planet encounters. The ultraviolet spectrometer, for example, is good for recording star bursts invisible to Earth-based telescopes. Another instrument continually counts cosmic rays. Yet another, the plasma wave experiment, is basically a radio receiver able to detect solar-wind ripples of charged particles and atomic nuclei that stream from the sun.

B814 has a surprisingly thick stack of paperwork behind it; Kathryn Weld, a sequence integration engineer with JPL, began putting it together four months ago. In November 1987 she had started taking requests from dozens of analysts and engineers, then pulled out conflicts and any order that might damage the spacecraft. Other requests had to go overboard because of mechanical limitations, fuel rationing, scan-platform rationing and the tiny computer memory available on Voyager 2. (Weld's entire B814 transmission, typed, would fit on four letter-size pages.) In December the team started transforming the surviving requests into computer commands. On a Wednesday afternoon in mid-February, exactly 12 hours before the transmission was to go out, she obtained the final signatures on the stack of approval forms her transmission required.

With a couple of minutes' key-tapping, Mogensen arranges for Weld's taped program to jump the Atlantic and go into temporary storage at the Madrid station. At 1 A.M. he tells me that the two files will start going up automatically in a few minutes; the transmitter is already warmed up and the antenna has only to hold its aim on Voyager.

This is not as easy as it sounds. With four minutes to go, Mogensen hears that the huge antenna has balked and lost its bead on Voyager. He drops our conversation and grabs the phone for some information. He reports in a little while that the transmission started automatically, though it cannot hit Voyager. "It's way out past the moon," he says, "and nearly to Mars by now. It'll keep going for a long time." Voyager is now so distant that radio signals, traveling at 186,000 miles per second, take three and a half hours to get there.

He adds that the B814 program isn't timed to start operating for another four days, so if the antenna stays

Nuclear energy, not foreign oil, is the best way to prevent electricity shortages

Electricity is so vital to our economy and our way of life that a shortage of electricity is unthinkable. Yet some parts of the country are already experiencing brownouts during peak periods of demand. The question is not "Will we run out?" The question is "What price will we have to pay?"

Our electricity demand will outgrow our present supply. It is only a matter of time. Federal planners believe that our current generating capacity may not be enough to supply our peak electrical demand in the 1990s.

America's electricity use has steadily increased for the last 50 years, and has grown over 45% since the 1973 Arab oil embargo. This growing electricity demand is already forcing us to turn to oil.

Imported oil: a dangerous fix

The longer we wait to build new coal and nuclear plants, the more we will have to depend on oil. Using more oil plants would increase our foreign oil imports, worsen our trade deficit, and make America even more dangerously dependent on foreign countries for crucial energy.

More nuclear plants needed

Nuclear energy is already America's second largest source of electricity after coal. By reducing the use of foreign oil to make electricity, nuclear plants have saved America $105 billion in foreign oil payments since 1973. Nuclear plants have also helped cut consumer electric bills by over $60 billion.

Nuclear energy reduces America's dependence on foreign oil, not only at electric power plants, but wherever electricity replaces oil. It supplies a large part of the electricity that our economy needs to prosper.

If you'd like more information on making America more energy independent, write to the U.S. Council for Energy Awareness, P.O. Box 66103, Dept. SH06, Washington, D.C. 20035.

Information about energy America can count on

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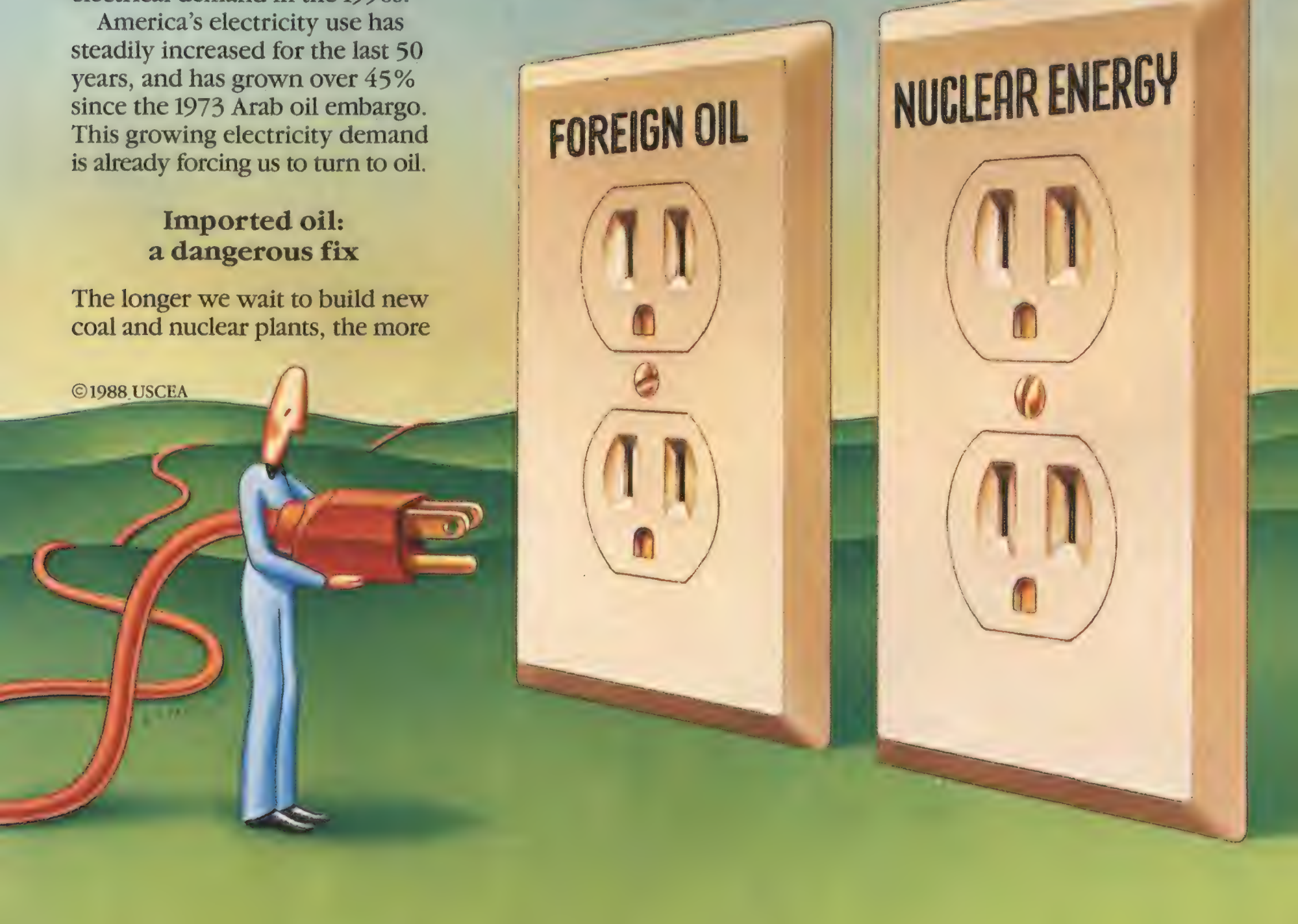

In Mojave Desert, Goldstone's Mars station spans 230 feet. It will be aimed to hear Voyager's messages.

out of action this morning, there's plenty of time to reschedule another transmission to Voyager 2. But Mogensen hopes to avoid it. The three antenna farms of the Deep Space Network are booked 24 hours a day and the shuffling would cost some other spacecraft its antenna time. For example, Pioneer 12, circling Venus, might not get to send its latest data.

Someone goes out into the Spanish morning to climb up and investigate, and sends back a report on the culprit: a misbehaving hydraulic valve. Just minutes later, the antenna is back on duty. Relieved, Mogensen returns to his terminal to set up another pair of transmissions to Voyager, an hour later.

This time, a totally different problem pops up: a hiccup in the pointing computers causes the antenna to drop its aim for a couple of minutes. But it happens in the five-minute pause between the short and long transmissions, and as the long transmission begins with everything working, Mogensen decides that Voyager will probably get the messages. There is no way of knowing for sure until hours later, when Voyager sends back a signal saying, in effect, "Got it, Boss."

And, seven hours and four minutes later, the acknowledgment arrives. No third try will be needed. Still, the night's transmission problem is the kind of thing that makes the Voyager researchers queasy. Any antenna-tracking problem during the Neptune flyby will produce great handfuls of scientists' hair, because a second visit to Neptune might not come in their lifetimes. Some of their information can be lifted from the tape recorder for a second try later, but there is only enough tape to store a small fraction of the scientific bounty that will pour in. Just a hundred video pictures will fill the whole reel of tape, and the imaging team plans 90 times that many pictures during the encounter. And the other teams will need space to store their measurements on the atmosphere, magnetic and radiation fields, rings, moons and the planet's effect on the solar wind.

Then Voyager 2 will leave Neptune behind, plummeting south of the solar system's vast disk at 36,000 mph. After the flyby, the JPL will shut off both Voyagers' cameras forever. This will save electricity to the vidicon tubes and power to heaters that keep them warm. But mainly, there will be nothing to use cameras on. At this point the project staff will drop to one-fourth of its size during the Neptune pass.

The fields and particles experiments and the ultraviolet spectrometer will be useful as long as the Voyagers hold together. When they leave the solar wind behind, at the boundary that scientists call the heliopause, these instruments will give humanity its first direct knowledge of the interstellar wind, made up of dust, hydrogen and other particles from the galaxy. (The Pioneer 10 and 11 probes have a headstart, but the Voyagers are faster and will get there first.) No one knows where this boundary lies, but the radio gear will probably start sniffing it within 12 years.

There are many good reasons why the Voyagers might not be working at the heliopause, though. According to JPL estimates, the sun sensor may not be able to keep its lock on the Sun after about the year 2029. The decay of the electrical supply is another problem; there won't be enough power to operate anything by 2018. Maneuvering fuel will be running low also, and the spacecraft can't hold steady without it. These obstacles all look insurmountable, but if the project's brilliant record is any indication, the operators may figure a way to squeeze out a few more years of life. Finally, cold and inert, speeding on for millions of years, the Voyagers will be alone to cruise the sea of stars.

Engineer Jerry Crook stands on base of Mars antenna, almost ready for Voyager's last flyby in August 1989.

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At final rehearsal for Juilliard presentation, students refine scenes to bring them within the allotted three minutes:

By Richard Conniff

For young actors, Tisch is the school of hard knocks

Rushing from ancient Greece to Edwardian England, from mock combat to the trapeze, NYU's theater students prep for judgment day

At 1:45 on a Sunday afternoon, the hour of judgment is bearing down fast. Nineteen talented and attractive young people walk around waggling their fingers and fluttering their lips. They suck down deep drafts of Evian water and consume dangerous quantities of Fisherman's Friend, a throat lozenge said to be capable of clearing out everything from here to Poughkeepsie. They are actors, this year's crop from the graduate acting program at New York University's Tisch School of the Arts. They are warming up to present themselves in rapid-fire succession—my life in a soundbite—to 200 of the most powerful figures in the theater, film and television worlds.

Upstairs at the Juilliard School, which will be hosting NYU, Yale School of Drama and its own Drama Division in a three-school presentation, the audience is already assembling: vice presidents for talent from Warner Bros., MGM-UA and MTM Productions; talent scouts from ABC, NBC and CBS; agents from ICM, TRIAD and William Morris; representatives of the leading regional theaters; and the independent casting directors who assemble the actors for almost everything that happens on a Broadway stage.

But don't let the pressure get to you. These VIPs are

Augusta Allen-Jones, Meghan Rose Krank; Ron Bottitta, Krista Helfferich; Oliver Wadsworth, Teagle Bougere.

nice people, dressed casually, some of them in sneakers and shorts. They could be out right now enjoying a brilliant afternoon in Central Park, but they've chosen to be here. To see you succeed. Do not, please, remind yourselves that a beginning actor on his own would have to spend three or four years writing letters and pounding pavement to be seen by such people. Try to forget that in the middle of your big laugh line the audience may be scribbling terse notes next to your own—or another actor's—head shot: "Commercial" or "Not commercial," "Skilled" or "Not skilled," "Immediately usable" or (sickening thought) nothing at all. Do not dwell on the idea that many of these VIPs will be weeding through the 50 young actors displaying their talents this afternoon to arrive at a short list of those deemed worthy of an immediate callback interview. At 7 P.M. the lists will be taped on a long black wall, where the actors will search prayerfully for their own names. Definitely better not to think about that. Time now to concentrate on the acting.

The group from NYU's graduate acting program has been preparing for this moment for three years. In that time, they have done little but concentrate on the acting, six days a week, often 12 or 13 hours a day. They have been turning themselves into character actors—a holy mission. They have also been turning themselves into a company, an ensemble, and they relish their collective role as the underdog in today's event. They are aware that this is not a competition among the three schools, but even so . . . Yale still dines out on the reputation of such graduates as Meryl Streep and Christopher Durang, Juilliard's name has a finely buffed classical patina, NYU is on the rise. Weeks before the presentation, Ron Bottitta, a third-year student, has a dream: two Juilliard actors are playing *Much Ado About Nothing*. Their Beatrice and Benedick face forward, passionate as codgers in a gentlemen's club: "I do love nothing in the world so well as you. . . ." Their classicism verges on rigor mortis: "Kill Claudio." Bottitta sleeps soundly.

This NYU class is only the second chosen and trained under Zelda Fichandler, who chairs the graduate acting program and is also producing director at Arena Stage in Washington, D.C. She has revived the NYU program after a period of drift, and has turned it to the task of producing actors for theater companies like her own. Character actors. For her, the term does not refer to a type—Sydney Greenstreet

Photographs by John Dominis

Students listen intently to director Paul Weidner's critique of their performance in scene from *Les Liaisons Dangereuses,* which they're preparing for the Juilliard event. "You want to keep a few rough edges so it doesn't get stale," he tells them.

Rosemarie Tichler, in her audition-preparation class, directs feedback to actors as they run through a scene.

playing the same part over and over—but the opposite: an actor capable of transformation. Her faculty has been teaching these actors how to live another person's life for a time on the stage. A hundred different lives.

From a practical viewpoint, any company of actors needs that versatility. A repertory actress must be able to become a randy 19th-century Russian aristocrat for the morning rehearsal and, in the afternoon, with equal plausibility, plant her foot in the anatomy of an ex-boyfriend from The Bronx who is hittin' on her 16-year-old sister. (As it happens, these are parts that NYU's Eliza Foss will play at the presentation, in two scenes of three minutes each.)

But Fichandler's idea of the character actor goes well beyond the practical. "You have to excavate the self," she says, "release the natural voice, the relaxed body, the instincts, the enormous amount of information stored up in the body. You must take your own stuff and sculpt it into the character by understanding how he lives his daily life, the dreams and secret thoughts of the character. That's the joy of it. To understand the mystery of the human experience." For her, the art of transformation is a sacrament. In the presentation audience, Philistines from afternoon television hungrily seek new faces, a tempting prospect for some of Fichandler's graduating actors. "I see the name *All My Children* and I think 'student loans,' " says Timothy Thomas, with mock yearning.

Zelda Fichandler, acting program head, watches Dan Berkey "transforming" self. "You must take your own stuff and sculpt it into the character by understanding," she says. "That's the joy of it. To understand the mystery of the human experience."

But Fichandler is uninterested in producing soap opera stars. She is a soft voice reminding her graduates to be artists, not hirelings.

Back in the middle of the spring semester, back at 721 Broadway, where the NYU program is based, students are rushing from one rehearsal to the next. They slam doors and make huffy exits, then huddle outside listening for their cues to reenter. It is ancient Greece in Room 522, Edwardian England in 523. From a voice class comes a sound like Tibetan monks chanting on massage tables—actors humming and pounding on one another's backs, "finding the body's resonance." In the "circus" room, the students are doing a relaxation exercise, their limbs flopping down as if they were puppets whose strings had been cut, total limpness in nine easy steps. They count off in English, then in Spanish, German, Thai, Japanese, Italian, Gaelic, Mandarin, Estonian, Danish, French, cat-talk, rat-talk and Texahoma ("Wun . . . tew . . . thu-ree . . .").

In the hallway, a bulletin board admonishes students with the single word "Believe." Below, newspaper clippings celebrate the latest accomplishments of the school's alumni. Barry Bostwick is starring in a television movie, and John C. McGinley has a part in Oliver Stone's film of *Talk Radio.* In separate reviews, the *New York Times* cites Nicky Paraiso as "no stranger to risky excess," and Susan Bruce, in a play at the Circle Repertory, as part of a "human constellation that flickers with eroticism and pain." The current students do not gaze on these notices with starry eyes. They are too busy.

Their training has begun with a process of stripping away—accents, mannerisms, postures, poses. A first-year actor presents his latest recording of a word exercise to a speech teacher: "Green fields. Calm father. Eighty-eight. I can't dance."

"Yes!" says the teacher. "You hit that right on the money."

"Ho-o-me alo-o-ne," the student intones.

"You got a little fakey on that one."

Thus they learn to say "surely cruel," not "sherly crool," and "Harry's character," not "hairy's care-acter." A young actress apologizes for her latest effort: "I'm sad. My *t* whistled." The aim is to master standard American stage speech before they move on to accents and impediments.

Also in the first year, habitual slouching comes under siege, shoulders broaden, the students begin to move with graceful economy—all the things their grade school teachers badgered them to do, except that few grade schools offer the Alexander Technique, a philosophy of posture and movement popular among actors and musicians. The idea, says Ann Mathews, who teaches "Alexander," is to give an education in self-awareness so the actor begins to rebuild his body for a bigger, better, more natural effect. The actor may

First-year students try "three-man hang" in circus course. Teacher Hovey Burgess takes the top position.

wind up playing a sloucher on the stage, Mathews concedes, but it's easier to go from gracefulness to the gutter, from Henry V to Ratso Rizzo, than vice versa. With Alexander, the actor also becomes an "inner observer" of movement, she says. Thereafter, if he threads a needle with the concentration showing in his whitened knuckles, it is for the effect and not because he's never thought of doing it any other way.

"If you're building a character," explains Mathews, "you want to be such an acute observer of human nature that you have a complete repertoire of movements that go with the character—a jerkiness, a sudden turn of the head, a nudging up of the shoulders—so you don't have the character full of your own unexamined mannerisms."

On a Saturday afternoon, Zelda Fichandler has shuttled up from Washington for a class. The process of stripping away does not destroy the self, she says. It reveals it. What the actors lose are the masks that hide the drama in everyday life. Once they've gotten back to the essential self, they can begin to expand into other people's lives. Fichandler sits in a folding chair on the side of a bare room, with 14 students sprawled out on the floor around her. She is a small woman, 63 years old, with a bank of dark hair falling stiffly across her left eye. Her chin rests on the thumb of her right hand, with the index finger extending up past the corner of her mouth. Her lower lip is slightly rolled out, giving her the appearance of constantly tasting, constantly weighing possibilities. "Let's warm up with a little 'as if,'" she says, her voice characteristically low. "A little imagination exercise."

"As if," a student begins dreamily, "my family had moved away from home and gone to school and I had to send them money to survive." Nervous laughter: with the help of loans and their families, they are paying $12,000 a year, just for tuition, to be here.

"As if the man who promised to marry me left me in the woods to die," another student says. "As if I felt beauty deeply and was ugly" . . . "As if I were a slave in love with my master's wife" . . . "As if you joined me in a bath of goat's milk and almond oil" . . . "As if it were my 30th birthday and I didn't know why I was a priest."

Scene to make a doubting parent nervous

Fichandler whispers something to the nearest student and he begins to writhe on the floor. Then he is up chasing his hand around the room, banging off walls, then back on the floor again, wriggling through an imaginary tunnel—a scene to make a doubting parent nervous: For $12,000, why didn't the kid just go to law school? Why didn't he join an investment bank? An actor's employment prospects are dismal, and the pay is generally poor. Is he

Martha Hughes lets four men have it in instructor B. H. Barry's combat class. First rule is, no one gets hurt.

As the student becomes more proficient, she moves to the next stage: to kick as her character would kick.

really going to feed a family on standing ovations?

By now, the student, intent on exploring the moment, has become a stewbum, scrabbling along with his lips smearing the floor. "Heighten and explore," Fichandler whispers. Fortunately, there are no parents in the room, just the class, the ensemble, with the students nurturing rather than judging one another, an idea calculated to help them try new things, risk failure, grow. He starts to count—"one-two, one-two, two-two-two . . . to . . . be. . ." The other students chuckle. "Or not to be. Not-not-not. Knot." He begins to pick at the knot in his sneaker, then gets the whole sneaker into his mouth and becomes a dog. Another student joins in, as the dog's abusive master: "Fetch or I'll box your ears." Then a daughter appears, to defend the dog, and a wife steps in between father and daughter. A domestic drama begins to unfold.

A frequent contributor, Richard Conniff began and ended his own acting career in a trunk in Peoria, Illinois. His job: knock loudly and wave an arm.

"The 'as if' lets you go anywhere you can imagine," Fichandler tells them afterward. "It's the essence of theater. It's the lever that pries open the magic box."

Fichandler has a formidable reputation in the theater world, and she can be oracular in her pronouncements. "She makes it sound very deep, very profound," says Andrew Colteaux, a member of the graduating class. "Everybody's supposed to walk around and look enlightened." But even Colteaux echoes Fichandler, perhaps inadvertently, on the importance of acting companies and of transformational acting. That is the idea: to give young actors a philosophical framework, a theatrical ideal, for when they go out into a business that often cares most deeply about P&L, which stands for profit and loss, and about T&A, which does not stand for tonsils and adenoids. Fichandler's voice has a way of staying with them.

She sends this day's class off with a Delphic "arc of thought," from a Russian author: "Habit devours objects, furniture, one's wife and the fear of war. . . . Art helps us recover the sensations of life. . . . The

technique of art is to make things unfamiliar."

"Let's start beating each other up," says a student in combat class, where the subject matter tends to be more technical than philosophical. B. H. Barry, who is orchestrating the mayhem in his 38th *Romeo and Juliet,* leads the acting students from elementary punching, scratching, kicking and biting, through assault by chair and vase, on up to the high art of the sword fight. At the moment, these budding thespians are learning to kick one another in the face. One student kneels with his back to the audience. The other approaches from the side, kicks, and seems to punt his partner's chin up into the catwalks. Everyone winces and someone cries, "Ow! I felt that." In truth, though, the foot has passed well in front of the chin, and the sound of impact has come from the "victim" clapping his hands. The rest of the class tries it, slowly at first. Then, just for fun, four men kneel in a line and a woman sends them sprawling with a single kick. "A word to the wise," says the teaching assistant: victims must not lean forward, and the assailant should use the near leg, because the far one is liable to hook. Barry's first rule of combat is that no one gets hurt.

But even in these technical realms, the idea is never merely to master the technique. If you're going to kick someone in the face, you must do it the way your character would kick. An instance arises in circus class. Hovey Burgess, who looks like Falstaff in a Siouxsie and the Banshees T-shirt, has been leading his students through a trapeze workout. They are enthusiastic: the rough, textured ceiling is gouged where their bare feet hit. Should anyone let go just before the height of the swing, his probable flight path would take him through a large window and into the factory across the street, where the seamstresses are oblivious to their peril. Terra Vandergaw, a first-year student, perches on the trapeze. Without warning, she slips backward

Laura Sametz (atop chair) as the Duke of Ephesus mocks Rob LaBelle as Egeon in *The Comedy of Errors.*

Bill Mondy (left) plays the Rev. James Morell, vents anger at Oliver Wadsworth as Marchbanks in *Candida.*

Modern interpretation of Shakespeare's play was one of nine productions put on by students in final year.

Marcia Gay Harden sobs as the child Serena in *Women of Brewster Place,* a student-originated project.

off the bar, headfirst toward the floor, until her ankle catches on a rope at the last moment. "It's like you're sitting on a cliff and you fall backwards," she says later. "It took me 15 minutes to do it the first time." Now she does it not just gracefully, but transformed into character for her entrance as Puck in *A Midsummer Night's Dream.* At the bottom of her plunge, she stretches out to the side and remarks with mischievous ease, "How now, spirit, whither wander you?"

"I feel like a play dictionary"

By the last week in April, Rosemarie Tichler, who teaches audition preparation, has seen her third-year students in 80 scenes. They have ransacked 19th- and 20th-century dramatic literature, broken the binding on the *Actor's Scenebook,* Vols. 1 and 2, and picked every available brain in a search for two short pieces to show off their talents for the presentation audience—something comic, say, and something dark, something from Shakespeare and something out of John Patrick Shanley. They have spent three years building a foundation for character acting. How to suggest that in two scenes of three minutes each? Is it better to show range, or to concentrate on parts that are most likely to bring job offers? Since they will be doing two-person scenes, they must choose pieces that also serve a classmate's talents and ambitions. "I feel like a play dictionary," Laura Sametz says.

Tichler scuttles a Pinter scene because too much hangs on the context, and another offering because both actors can do better elsewhere. She considers student Ethan Bowen as a romantic lead, a stockbroker whose girlfriend is schizophrenic. Bowen has a high, narrow forehead and deep-set eyes full of intensity. His classmates once voted him "most likely to commit an ax murder." Tichler thinks this part will serve him because it is less dark, more sympathetic. The scene also works for his partner, Augusta Allen-Jones, because her other role in the Juilliard presentation will be as an older, very controlled, very knowing French aristocrat. "People need to see her doing American work," Tichler says.

It is a bewildering time for the class because so many factors other than talent are in play. They have learned to transform themselves within, becoming almost any character. But they cannot transform their physical appearance, and that suddenly seems crucial. "You talk to agents and they really do care about your height and your weight," says Allen-Jones. "I see a lot of people worrying about breast jobs and nose jobs—changing themselves with knives. That bothers me. I'm a little afraid for myself." They worry that their features may cause them to be typecast. Gary Dean Ruebsamen, voted "most normal" in the class, is

Faculty head Ron Van Lieu directs first-year student Christine Mourad in her portrayal of Laura in *The Glass Menagerie.* A gifted teacher as well as frequent director, Van Lieu is himself a former student in the NYU graduate acting program.

playing two all-American boys because he looks the part and because he wants the bread-and-butter work. But will anyone notice that he can do other things, too? Susan Norman has been told by an agent that she looks like the young Susan Dey from *The Partridge Family.* She shudders to think about it.

"What are they looking for?" a plaintive voice asks at a class meeting.

"Cheekbones," comes the reply.

It is also a bewildering time because so many things other than the Juilliard event are happening at once. The third-year students are in the middle of two full-scale productions, Shaw's *Candida* and Shakespeare's *The Comedy of Errors.* They have back-to-back rehearsals into the night, as many as a half-dozen roles in a day: scenes for their productions, scenes for the presentation, scenes for the auditions they are already starting to line up in the real world.

Marcia Gay Harden has had repeated callbacks for the part of the manipulative "older woman" in the film of *Les Liaisons Dangereuses* and she is auditioning now with its director, Milos Forman. This is the same character that Augusta Allen-Jones will be playing in the presentation. "I bet her $20 that she's going to be in the film," says Allen-Jones, "and I hope she is, because I need the money." Everyone in the class is also trying out for the New York Shakespeare Festival. They hope for work as spear-carriers and handmaidens—a chance not just to play Shakespeare but to stay in New York and continue to audition. Rosemarie Tichler happens to be casting director for the Shakespeare Festival, but now she will be just a voice in a darkened theater saying "Thank you, we'll call." The first of many.

Early in May, Tichler and Paul Weidner, a director who is on the school faculty, make the final presentation cut, to 19 scenes. Then Weidner sits down with a stopwatch ticking in one hand and a pencil in the other, scribbling notes. The first job is to get each scene down to three minutes so that the whole NYU segment comes in under an hour. "We're at two and a half," each team of actors announces brightly at the start. And each time, the heartless stopwatch says three and a half—or worse. Teagle Bougere is an exception, bringing in a scene from *Joe Turner's Come and Gone* in two minutes. But then he tries to borrow the extra minute for his other scene from *Master Harold . . . and the Boys.*

"Nine and a half," Weidner announces to Laura Sametz and Marcia Gay Harden, who are playing a scene with New York accents.

"No way!" they reply, still in character. "From when?"

"From when you started."

"How can that *be*?" Sametz cries.

"It's a nightmare!" calls Harden.

Then they start to cut, hacking out bleeding chunks of dialogue. Weidner draws a heavy line through a paragraph. "But that's funny," Harden laments. "I know," says Weidner. Even Shakespeare goes under the knife. "You have to be a little insensitive and not worry about the play's integrity so much as about what hangs together for those three minutes," Weidner explains.

The other task is to shape each scene so it has movement, color, give-and-take. Weidner roams like a sculp-

DEWAR'S PROFILE:

JEREMIAH TOWER

HOME: San Francisco, California.

AGE: 45.

PROFESSION: Head chef and owner. Stars.

HOBBY: Running the Society to Stamp Out Kiwis. "The fruit, not the bird."

LAST BOOK READ: *Bread and Circuses*, Patrick Brantlinger.

LATEST ACCOMPLISHMENT: Wrote a cookbook, *New American Classics*, featuring such recipes as Eggs in Hell, Texas Style.

WHY I DO WHAT I DO: "With a B.A. and M.A. in architecture from Harvard, it's hard to explain, but it's a lot of fun."

QUOTE: "Fresh herbs."

PROFILE: Aristocratic, confident and a self-described monarchist. "Everyone likes to have things his own way. I just admit it."

HIS SCOTCH: Dewar's® "White Label®" with soda. "I particularly enjoy something I don't have to cook."

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Student Michael Gaston dons a character mask to help him find emotion behind body movements.

tor around two actresses, Ami Brabson and Andrea Bahmann. First he stands in front as they play a scene, his hands on top of his head and one leg crossed over the other at the ankle, considering the effect. Then he comes sliding in between them on his knees. "Ami, what was that line?" he asks. When Ami tells him he says, "Hmmm. What does that mean?" The two characters, Rosalind and Celia from *As You Like It*, are teasing each other about love letters they have found, and their dialogue is full of Elizabethan repartee that threatens to bubble and turn cute. "Let the attempts to get the letters come at the end of the line, so it goes wit-wit-wit-boom," he suggests. The action begins to support the dueling character of the words. They then try a different stage movement he has just dreamed up, and as he watches he sways to stage left in sympathy with them.

"Concentrate on what you want, and what you show you want or don't show you want, and on where the want changes," he tells the students. "We need to bring out the points where it goes back and forth and keep those sections clean, because that's where the fun is."

Weidner finally brings all 19 scenes together the Tuesday before the presentation. "How are all you mothers?" he calls out. (They are nervous, these mothers.)

Frantic sit-ups, shapeless scenes

Ethan Bowen finds himself playing not one romantic lead, but two, and he is shirtless for the second. He has begun doing sit-ups, frantically. Andrew Colteaux has only just started to enter his part as a scary, truculent boyfriend in Lanford Wilson's *Burn This*. At first he was hung up on John Malkovitch, the actor who created the part on Broadway; he couldn't find his own way into the character. But now he has picked up a different way of moving from a man he spotted in the street and he thinks the new approach will work. The scene, however, is still shapeless. "An amoeba," says Weidner, who is undaunted.

Weidner spends the last few days doing close work on the amoebas, and light polishing on the scenes that are more finished. "You want to keep a few rough edges, so it doesn't get stale," he says. He moves out of the classroom and into the school theater for a rehearsal devoted to vocal projection. Another rehearsal concentrates on the transitions between scenes, so that there will be no sags or miscues.

"Will the audience Sunday laugh?" Laura Sametz wonders.

"Not a lot," says Weidner. "They're too busy. They're making notes about you and they're making decisions about your work as you go along."

"That's the big surprise," Fichandler tells them. "That it isn't opening night. It's the matinee on Wednesday."

Saturday afternoon they move uptown to the Juilliard School and take the measure of the space where they will actually perform. Weidner has chosen Craig Stearns to introduce the group because he plays a Russian comic and a moronic American teenager in his two scenes, and this will give him a chance to show that he can speak plain English: "We are the actors of the graduate acting program at New York University." At the final rehearsal, Stearns flubs the line and falls writhing to the floor, but he gets it right on the second try. Playing a scene from *The Actor's Nightmare*, as an actor onstage in a play he never rehearsed, Andrew Colteaux actually forgets his lines, bolts from the stage and reemerges looking flustered on the other side. It is a felicitous mistake. His classmates roar their

approval, and Weidner has Colteaux keep the bit in.

There are still small problems to clean up. Weidner has decided to have the whole class onstage throughout the presentation, because they are an ensemble and because they will be "less jittersome" together. He fusses over the arrangement of chairs. He rearranges scenes to make better use of this theater's space. He pushes for a quicker pace on transitions. But at the end of the day he pronounces himself pleased and sends the group home with an admonition to forget about everything except starting time tomorrow.

That night, Andrew Colteaux finally types his résumé. Ami Brabson wakes up at 2 A.M. and staples hers. Bill Mondy has a dream: all 19 scenes have been junked at the last minute and they have been asked to play Ibsen's *A Doll's House* instead. "But I don't know it!" he cries. Laura Sametz tells him not to worry because they can use the script onstage. He gets his script just before curtain time and opens it in a fever. Everything is written in phonetics, a subject he had neglected.

It is a relief to assemble again on Sunday, and as the real curtain time draws near they loosen up their voices and stretch together in a rehearsal room downstairs. They join hands and sing a sort of monastic chant. They stomp and clap. They dance out into the middle of the circle. They whoop. It is a cross between a halftime football rally and a gospel meeting. They fall silent. Then Rob LaBelle throws his head back with a crazed, gleeful grin and says, "Yeah!"

"Let's just remember we're not alone out there."

"We've got us. Just look around this circle."

"We're good."

"Damned good."

The VIPs in the audience do, in fact, laugh. They also take notes. Some head shots are circled, or marked with stars, or surrounded with scribbled comments. Some are blank. The NYU actors leave the stage to Yale and Juilliard with a sense of having done well.

They spend the rest of the afternoon trying to think about anything other than "that stupid wall" where the callback lists will be posted. But finally, a woman comes into a reception room where actors from all three schools are mingling, all of them palpably trying not to think about the same thing. "OK," the woman announces. "Everything's posted upstairs."

Then, in twos and threes, acting casual, acting, for once, quite badly, they head up Stairway B to confront their futures.

Elated students hug each other and their director after presentations that climax the three-year program.

Before going on, they rallied their spirits with "We're not alone out there... we've got us... we're good."

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By Eric Dinerstein

Nepal's 'land rovers' cover themselves with dust, and glory

The safest place to be when you're looking for rhinos in Royal Chitwan National Park is on the broad back of a resourceful elephant

Waiting for elephants to be saddled, trackers and drivers huddle around morning campfire in Chitwan.

The Land Rover hurtled and lurched across the East African bush, alternately chasing and being chased by a huge, black rhinoceros. John Wayne leaned out of the open vehicle and nonchalantly lassoed the beast, reeling it in as if it were no more powerful than a small fish. A few scenes later, the film *Hatari!* ended, the houselights in the New Jersey movie theater came on and an impressionable 9-year-old boy made a career decision: drop plans to attend law school and go chase rhinos in Africa instead.

My illusions about the swashbuckling existence of a wildlife biologist vanished in graduate school, where I discovered that most field-workers don't study large, charismatic creatures. On the contrary, they are far more likely to toil on their hands and knees catching insects or rodents. But in my professional fantasies, I still hungered for the thrill of bouncing across East Africa behind the wheel of a Land Rover, in reckless pursuit of rhinos. I finally got my chance—not in Africa, it turned out, but in the 25-foot-tall grasslands of Royal Chitwan National Park in Nepal, and not in a conventional safari vehicle but, rather, on a non-motorized type with huge limbs for wheels, a broad back instead of a roof rack, and a trunk that's used as horn, metal detector, cherry picker, pruning shears, escalator, garden hose and exhaust pipe. I'm referring, of course, to a domesticated Asian elephant.

When scientists affiliated with the Smithsonian began studying tigers in Chitwan in 1973, they took a tip from the great hunters of the raj: if you want to catch tigers in tall grass, trained elephants are a necessity. The same goes for capturing and studying the greater one-horned rhinoceros. I've relied heavily on elephant labor during my research, a project supported by the Smithsonian, the World Wildlife Fund and His Majesty's Government of Nepal, but assisted even more directly by Chanchal Kali, Mel Kali, Prem Kali, Kirti Kali and Maan Kali, our five pachyderms (Kali is a fierce Hindu goddess). During the past four years, I've been tremendously impressed by their intelligence, courage and resourcefulness, and I'm indebted to them not only for the important work they've performed but also for the way they've done it: with grace and what I can best describe as good humor.

My memories of life with the elephants are tied to the cycle of the seasons in Nepal: the steamy, summer monsoons, when the creatures become our riverboats; the short winters, when we use them to track individual rhinos around the clock; and the long, hot springs, when we march them through the grasslands to census Chitwan's endangered rhino population.

When I first arrived in Chitwan in the summer of 1984, a monsoon deluge had drenched the floodplain and filled the Rapti River, cutting us off from the rhinos we wanted to study on the far shore. For our sturdy elephants, however, crossing swollen rivers is all in a day's work. Chanchal Kali, the tallest and strongest, enters the current first. Angling upstream, she strides confidently across, creating a wake and breaking the force of the river for her shorter stablemates.

Photographs by Lori Price and Thomas L. Kelly

After bathing, elephants use trunks to "powder" themselves with dirt. The animals so love this sport that drivers have to dust them off with gunnysacks. True skin color is often masked by color of the soil.

Nepal's resourceful 'land rovers'

Chanchal Kali, the strongest elephant, herds adult male rhino out of tall grass to be photographed for census.

Maan Kali, 22 years old, brings up the rear; she's our smallest and newest elephant, a mere dinghy among four cabin cruisers.

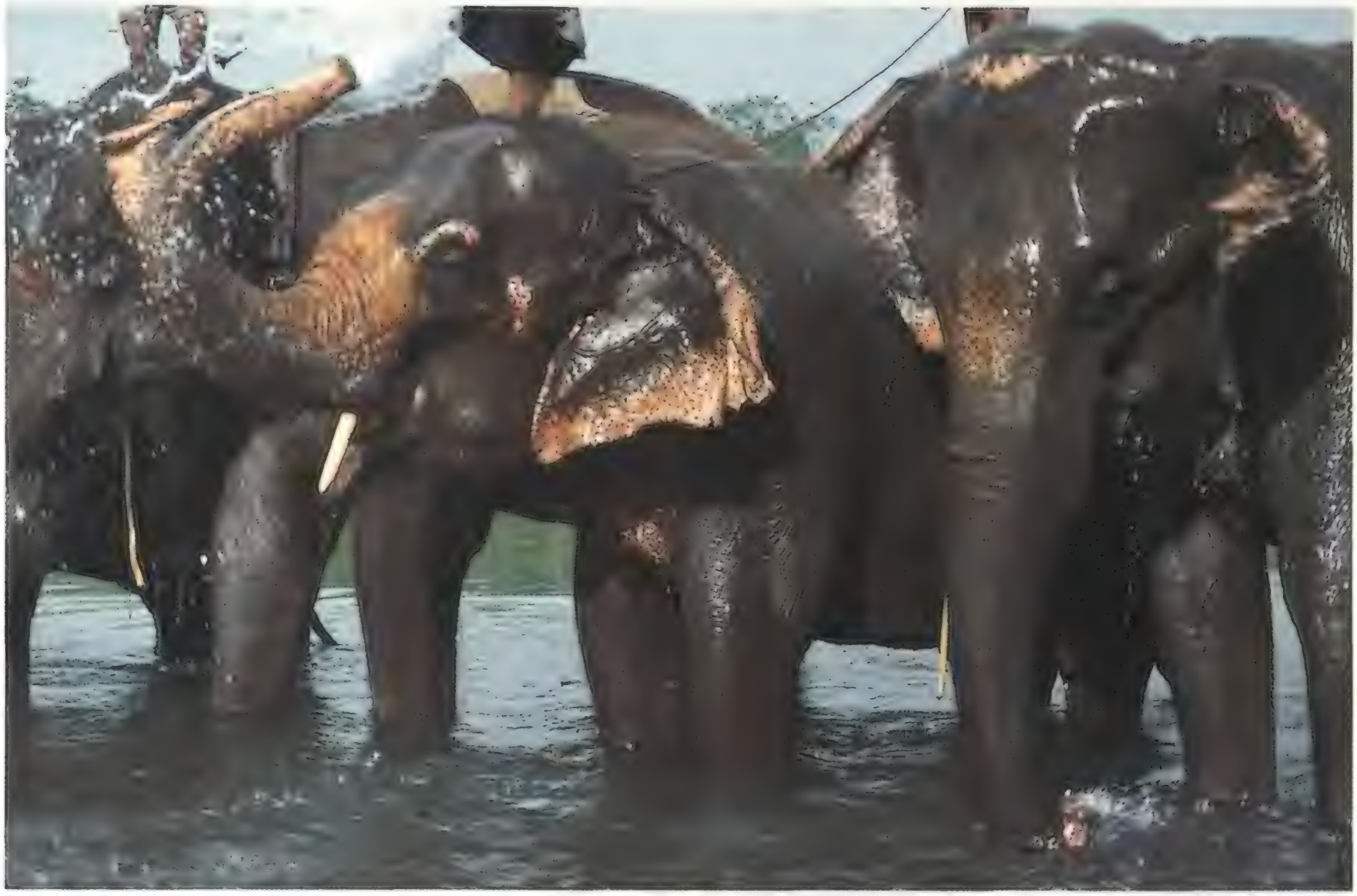
After crossing the Rapti, we head for the tall grass. Known generically as elephant grass, this mélange of about seven different species received its name because elephants eat it and also because the enormous stalks dwarf the animals. One kind, *Saccharum spontaneum*, a wild relative of sugarcane, serves as an important staple for both elephants and rhinos. Sometimes this grass becomes so thick that only a rhino or an elephant can push through it. The sharp-edged leaves slice up human pedestrians, and even seasoned trackers can lose their way in the tangle when working on foot. I quickly realized that elephantback was the way to travel for the rhino researcher who prefers to have his name attached to a scientific paper rather than to an obituary. Several people are trampled or gored by rhinos in Chitwan each year and a few belligerent animals even practice jeep bashing. But sitting behind a driver ten feet above the ground on an elephant, you feel like a modern-day Hannibal—invincible, though occasionally a bit seasick.

Today our mission is to locate a radio-collared female rhino that was seen recently with a previously unreported calf. Because one of our research objectives is to photograph and identify all rhinos within the park, we want to register this new arrival. The signal from the radio-tracking receiver grows louder, and then we come upon the pair. The mother is submerged up to her nostrils in a muddy wallow. The calf, too small to touch bottom, reclines on her back. A country club of tiny frogs sunbathe on top of both of them. During the humid monsoon, rhinos wallow up to eight hours a day, serving nicely as predator-free sun decks for social amphibians.

Another picture for the family album

The calf, startled by the sound of our elephants feeding on the grasses around the wallow, slides off its mother and paddles to the edge. Emerging from the pool, all head and ears, it utters a helpless "miya, miya," the contact call of a baby rhino. We lift our binoculars and are able to determine that it is a male. We keep our distance, for on several occasions one of these adorable but dim-witted little characters has mistaken a nearby elephant for its mom, initiating a dangerous fit of maternal jealousy.

After photographing the calf, I motion for the drivers to fan out on the floodplain. We will see if we can find any other rhinos on the way back to camp. Suddenly, Mel Kali, bobbing through the thick grass to our left, bangs her trunk against the ground with a loud thump. She has the most acute nose for tigers and now



Mel Kali (left) and Kirti Kali take a bath. To keep cool, elephants bathe often. They're scrubbed down by drivers, on whose command, "Sup, sup!" they suck up water with trunks and toss it over their heads.

she's picked up the scent. "Bhaag, bhaag!" the driver whispers gleefully to me, "Tiger, tiger!" He flashes that adventurous smile our mahouts show whenever danger is at hand. My elephant, Prem Kali, lifts her trunk over the rustling stalks to sniff the air and then brings it down heavily on the ground. Thump! Then she proceeds to emit a deep rumble, which is soon picked up by the other elephants.

The tiger, a big male, waits until we are nearly on top of him and unleashes a thundering roar, flashing by us in a blur of orange and black. Unable to contain herself, Prem Kali trumpets and the other elephants join the chorus, but in seconds the tiger is leagues of grass away and the excitement is over. Bir Bahadur, her driver, pats Prem Kali's forehead with his right hand, a signal to calm down and mute the trombone. Over the past 15 years, our elephants have helped capture many tigers, but each encounter is always a bit hair-raising for man, elephant and cat.

Field ecologist Eric Dinerstein wrote about his study of rhinoceros under the Smithsonian/Nepal Terai Ecology Project in the September 1987 issue.

The drivers cluster the elephants and take a break, sharing cigarettes rolled in local *tej* leaves. We can tell from the noises the elephants make that they are still excited after the close encounter with Chitwan's largest carnivore. Only recently has it been discovered that elephants communicate by using subsonic frequencies, a sort of secret language below the threshold of the human ear. One component that we can pick up is that deep rumble. When the animals head home to dinner or stand together, they bubble contentedly. In the presence of tigers, this sound speeds up considerably, resembling the dual exhausts of an Italian sports car turning over on a wintry morning.

After finishing their cigarettes, the drivers nudge the elephants behind the ears with their feet, steering them homeward. Within seconds, they are steaming back to camp, racing to see who will get there first. Upon our arrival, the drivers shout and whistle to their assistants to unsaddle and tether the creatures. The animals rumble and roar, clamoring for dinner. Their repast begins with hors d'oeuvres known locally as *kuchis.* These consist of around 30 pounds of a mixture of raw, unhusked rice, crude sugar and salt, wrapped with

The mahout, or driver, mounts by first grabbing the ears and placing foot on trunk; elephant lifts him up and he climbs up to neck, where he sits with his bare feet behind the ears. Most of commands are verbal, but can be reinforced by kicks.

Prem Kali watches handler make *kuchis*. Treats keep the animals returning faithfully to camp each night.

grasses into melon-size balls. Arranged neatly in front of each animal, *kuchis* resemble pachyderm sushi, and the elephants savor them. *Kuchis* precede the main meal of about 300 pounds of tall grass canes, or tree limbs, depending on what's in season.

Grabbing a *kuchi*, I place it in the side pocket of my field vest and then stroll up to Maan Kali. The elephant knows how to play this game. Squeaking happily, she hoists her trunk and deftly picks my pocket with the skill of the Artful Dodger.

By early October, the winds have begun to shift and the long monsoon is over. Hidden in the clouds during the summer rainy season, the 26,000-foot peaks of Annapurna, Dhaulagiri and Himalchuli now reappear across the northern horizon. One afternoon, while Kirti Kali grazes beneath us, I tell Gyan Bahadur, her driver, about a trek I once made around the Annapurna Range. He listens more out of politeness, I suspect, than interest.

To a Nepalese elephant driver, the snowy peaks to the north or the capital city of Kathmandu, only 90 miles away, must seem as distant and foreign as they would be to Americans. Most of our drivers have never ventured far beyond Chitwan, but then, what need have they to travel to the capital? A driver in Kathmandu, after all, is a driver without his elephant, and a driver without his elephant is a man without his identity.

Author Dinerstein stands on back of Prem Kali to spot rhinos in the tall grass. He quickly discovered that elephantback was the best mode of travel. Humans on foot can easily lose their way, be cut by sharp leaves or attacked by rhinoceros.

Gyan walks with the ducklike gait typical of the mahouts who have straddled elephants for several decades. His mind holds many stories about life with the elephants, and on this day he launches into one of them. A mahout he knew had fallen asleep on the back of his elephant. If mahouts trust their elephants when they are grazing, Gyan informs me, they remove their *lungis* (known as sarongs in the West), cover themselves and take a nap. This particular driver's *lungi* slipped off his body while he was snoozing and fell to the ground. The elephant stopped, picked up the fallen garment with its trunk and tossed it back over its slumbering master.

The elephant's penchant for retrieving fallen or lost objects can be a blessing when you're traveling through tall grass. Lens caps, ballpoint pens, binoculars—if you drop it, chances are your elephant will find it. One winter night, I assigned myself the graveyard shift in a 24-hour watch on a radio-collared rhino. As part of our research program, we sometimes followed a tagged animal for an entire day to study behavior, food habits, movements, which of the males got to breed and which ones lived in enforced celibacy. That night we had been tailing a bull that was hanging around a female in heat. Our elephant, Kirti Kali, understanding the need to follow closely, hustled along without any urging from Gyan Bahadur. All of a sudden, though, she stopped in her tracks and I lurched forward, crashing into Gyan. The rhino was getting away. Gyan began urging Kirti on, first by muttering curses and insulting her lineage—all in Bhojpuri, the language the drivers use with their elephants—and then with kicks behind her ears. But instead of moving forward, she took two steps backward, reached down with her trunk and lifted up my field notebook containing that night's data. Then she placed it carefully on Gyan's lap. We had not noticed when it slipped off her saddle, but the elephant was more alert. With the notebook safely in our hands, she charged back to work.

Basic training for domesticated elephants, including the command "Pick it up and hand it to me," begins early. By about the age of 3 the animals master the simple commands: lie down, roll on your side, stand up, lean forward, break a branch, look with your trunk, bring feet together, stand still, sit still, trumpet, attack, drink, squirt water over the head, drop it, quit it, and, the most useful command of all, *stop*.

Most elephants in Chitwan are purchased as young adults from used-elephant dealers. Several winters ago, when we needed another elephant, I had Baddhai Lal, our most experienced hand and the head of our stable, accompany me on a shopping trip. Judging the quality of a good elephant requires a keen eye. Many elephant traders are reluctant to part with the secrets to assessing good pachyderm stock, but some defects are com-

mon knowledge: never buy an elephant with an extra ear fold or pink edges to the ears (a sign of senility); avoid long-legged elephants (bad gaits); watch out for animals with yellow eyes (this one is a superstition); and beware of an elephant with foot cancer (a not uncommon disease among older animals that is often covered up by swindlers). Baddhai took a fancy to a female named Maan Kali, even though she appeared rather thin and was only 18 years old. We inquired about the price, and the dealer shocked us: "For you, only $6,000." He explained that the high cost was a result of India's recent ban on the capture and export of wild elephants for domestication.

Wild elephants are still abundant in Assam, India, and nearly all of Nepal's domesticated elephants hail from there. Only a few females have been bred in captivity in Nepal. Stable managers are generally reluctant to grant working females the two-year maternity leave necessary to raise their babies. Perhaps this policy will change with India's ban on exports.

Buying an elephant, like purchasing an expensive car or a yacht, carries a hidden burden—high upkeep costs. This overhead inspired the Nepali adage, "To take revenge on an enemy, buy him an elephant." At first the recipient of your gift will be humbled by your generosity. Then he will be made a pauper as the elephant eats him out of house and home.

Despite the king's ransom that the dealer demanded, Baddhai insisted that Maan Kali was a good investment, so we handed over enough rupees to fill a wheelbarrow. The wisdom or folly of our purchase would become known only when Maan tromped out into the jungle with the other elephants. Previously, her fiercest rivals had been barnyard roosters. Perhaps realizing this, Baddhai instructed that she be tethered next to Mel Kali, our bravest and most sociable elephant. Mel is the first elephant to be sent in to see if a tiger that has been darted for capture with a tranquilizer is fully sedated, a task most others prefer to avoid. Cohabitation paid off, for Maan Kali quickly overcame her initial shyness and then picked up her adopted sister's courage.

The winter that we bought Maan Kali, we had been trying to capture, sedate and radio-collar a tiger for a foreign film crew. By mistake rather than design, Maan and her driver happened to be deployed exactly where a tigress and her two grown cubs, encircled by our elephants and a ring of white cloth, exited abruptly by jumping over the cloth. The tigress growled menacingly, but sturdy little Maan held her ground while another elephant nearby turned and fled. Bravery is only partly an acquired trait. A shrewd judge of elephants, like Baddhai, must be able to read what is in their hearts.

The jungle skills of our elephants and their drivers are tested daily with the coming of the hot season. That's when we begin our annual census of the rhino population. By mid-February, fires set by local villagers and elephant drivers burn off the tall grass, and rhinos spend long hours grazing on the new shoots. We photograph, from elephantback, every animal we encounter. We mount the pictures in a register, a sort of

Driver "parks" Prem Kali in front of author's house in Nepal as if she were family station wagon. He stands on elephant's back in order to load gear for the trip out to camp. Using trunk, Prem can lift bundles from ground to driver, but usually they're thrown up by helper.

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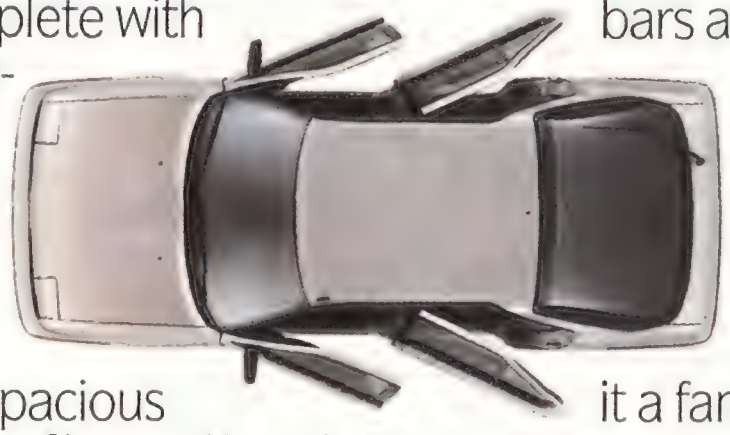

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Driver holds umbrella while 22-year-old Maan grazes. Violent thundershowers occur frequently in the spring.

rhino high school yearbook. The animals' thick armor-like folds, odd bumps, crooked tails, horns, scars and cut ears enable us to distinguish among them.

During the census period, our day begins at about 5 A.M., when we awake to the cacophony of rumbling elephants, brain-fever birds and blossom-headed parakeets. After a quick cup of tea we mount up, and within minutes we're on the floodplain, the elephants spacing themselves out so as not to miss any rhinos that might be sleeping in the grass. One of our trackers, riding on Chanchal Kali, mimics the clear whistle of a black-headed oriole—the signal that he has spotted a rhino. When he holds up two fingers of his right hand, we know it's a female and calf. Instantly, the drivers push their elephants to form a wide circle around the pair. Our modus operandi is relatively simple. While Bir Bahadur and I wait on top of Prem Kali, the others close in around the rhino and her calf, driving them toward us. The idea is to make them pass right in front of us, and maybe even get them to stop for a moment so I can take a good picture.

That sounds a lot easier than it is. Herding a wild rhino, especially a mother with calf, takes teamwork and courage on the part of the drivers and their elephants. Now, for instance, our mother utters a warning snort and turns to face the intruders. Before I can use my camera, she lurches straight at Maan Kali, bellowing like a prehistoric bull. Little Maan resolutely charges forward and trumpets, driving the mother and calf back into the ring. Given a second chance, I quickly photograph the pair.

When I'm out on a census, it sometimes staggers and saddens me to think of how few greater one-horned rhinoceros are left on this planet—so few that it's possible to photograph and recognize each one as an individual. After three dry seasons spent in the field, I estimated that between 380 and 400 animals survive in the park. By monitoring closely the interactions among breeding male rhinos, I discovered that turnover is rapid, a natural mechanism to maintain genetic mixing. And from blood samples taken from these and other animals, we learned that despite the relatively small size of the Chitwan population, and its isolation, genetic variability remains high. This is a critical factor in the long-term survival of the species.

This Mr. Universe is a lot of bull

During our rhino searches we often encounter some of the other four-legged exotica of Chitwan, the most exciting being the gaur, or Indian bison. This creature belongs to the wild cow genus *Bos*, and at nearly 2,000 pounds is its largest and most truculent representative. The bulls are truly impressive, with massive horns spanning up to 41 inches; they are as handsome as they are aggressive. The rich, dark color of their oily, muscle-bound bodies contrasts sharply with their white legs, making each one look like a bovine Mr. Universe in sweat socks.

Our elephants seem more afraid of bison than of any other mammal. Perhaps it's because we rarely encounter them, or maybe it's because the elephants fear being gored by their sharp horns. Once, while we were out looking for rhinos, Mel Kali stumbled upon a lone male bison. I was up on Prem Kali not far away. Mel began rumbling loudly, and immediately Prem, who could not see, smell or hear the motionless bison in the tall grass, charged straight at Mel, who was standing her ground against the immovable male. Hanging on tight, I was certain that Prem had gone berserk and was going to attack Mel. The driver and I were mere passengers, now, on this out-of-control elephant, and we braced for a head-on collision. But two feet from Mel's side, Prem swerved sharply, and together the two elephants, stablemates and friends for years, charged the bison and drove him off. Mel's subsonic SOS had

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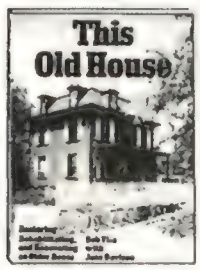

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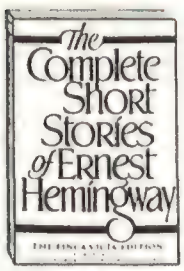

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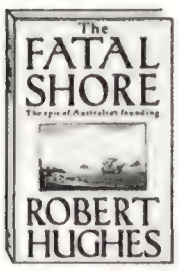

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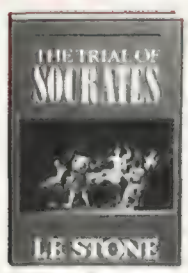

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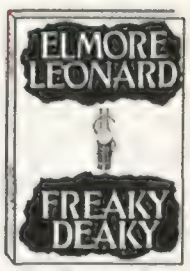

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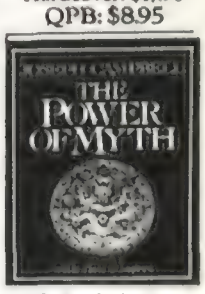

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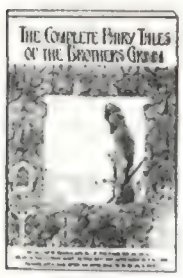

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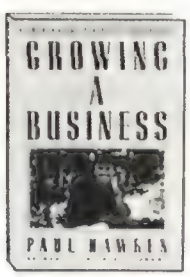

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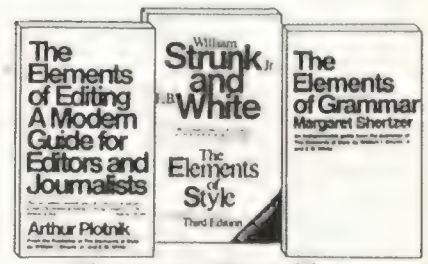
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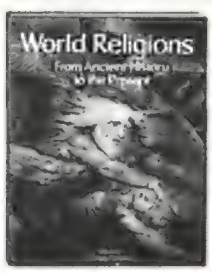

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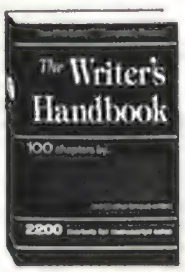

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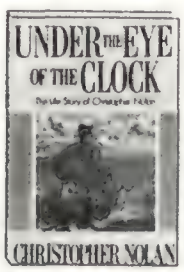

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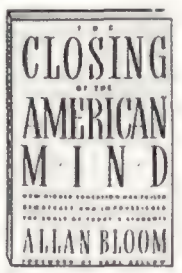

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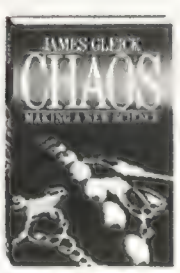

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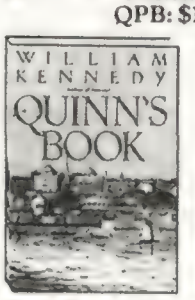

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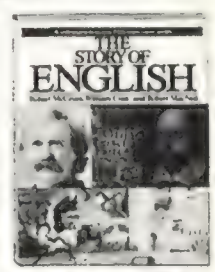

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been picked up by Prem, even though we had no idea of what was happening.

When it gets too dark to continue our census work, we decide to call it a day. We pull into camp amid good-natured taunts and whistles from the cooks, and excited rumbles from the elephants. There are 26 of us altogether: 16 drivers and caretakers, 7 game trackers, 2 cooks and myself. Our makeshift camp blends in with the thick cover of Murraya shrub, a wild citrus whose white flowers fill the air with a spicy fragrance. The mahouts chain the elephants to the fig trees and toss them their rice balls. Our own dinner of boiled rice, lentils and wild greens, laced with hot chili peppers, is eaten quickly and gives way to the evening's entertainment.

Mel Kali picks up her tether chain with her trunk and begins rapping it against the fig tree, begging for a few more *kuchis*. This is not part of the evening's entertainment. "Raa!" shouts her driver, which temporarily halts her percussionist inspiration. Some trackers and drivers play *paphlu*, the national card game, while others try their luck on the carom board. The gambling, jokes and repartee underscore the carefree atmosphere of jungle life.

The evenings are also a time for stories—tales of life up in the mountain villages where some of our staff grew up, stories about wives and children, about sly dealers in the bazaar and about the spirits of the jungle. My favorite involves the witch whose feet are on backward, the one who lures helpless young men into the jungle never to return. Eventually, the talk always comes back to elephants: the great tuskers of the past, the time when our Chanchal Kali ran away for three days, the time when a tiger jumped on top of Prem Kali and raked her driver. Right on cue, Mel Kali goes back to her chain-rattling and dust-throwing. "Chhii!" shouts her driver, meaning "Quit it!"

Around midnight, it's time for lights out. The sounds of the jungle reemerge—the "whook, whook" of the brown hawk owl and the metallic "chunk, chunk" of the long-tailed nightjar. I stoke up the bonfire next to my tent. According to the old jungle hands, an all-night campfire keeps the tigers away. Out here, where we have captured several man-eaters in the past three years, it makes a lot of sense to embrace the conventional wisdom.

Before turning in, I check the elephants tethered nearby. The animals require little sleep and lie down for fewer than five hours a night. The rest of the time they spend noisily chewing on branches, rubbing against trees or talking to one another. Unlike deer, cows and other ruminators, elephants are hind-gut fermenters. Consequently they pass tremendous amounts of intestinal gas, and their nocturnal flatulence is enough to keep a light sleeper up all night.

Elephants don't keep me awake, but the sound of a tiger usually does. One night, my eyes snapped open when I heard a deep, familiar moan. I unzipped the tent and crawled out. If a tiger does wander through camp, its unexpected appearance can spook the elephants and create bedlam as they trumpet in excitement. But this cat was too far away to interrupt their snores and the more-frequent sawing of their drivers. Four elephants lay sprawled on their sides. Only Chanchal Kali, the 60-year-old matriarch of our stable, stood awake in the moonlight, having drawn guard duty. Baddhai once told me that rarely do all five elephants sleep at the same time. Rumbling softly, Chanchal held out her magnificent ears in response to the sounds of the tiger searching for a mate, catcalls on a hot spring night.

Before I know it, the rains of June are upon us once again and another year has passed. Our research project is nearly completed and my time among the elephants is almost over. So, it appears, is the grand tradition of elephant husbandry. But where there is still work for elephants to do, there is still hope, and in countries like Burma and Thailand elephants continue to be used for logging. In India and Sri Lanka, domesticated elephants are stabled near temples, for the animals are considered the reincarnation of the Hindu god Ganesh. Each time we climb on board our elephants, we touch our hands to their skin and then to our foreheads, a sign of blessing from Ganesh. The only non-Hindu on our staff, I do it anyway, for it's hard not to share in this gesture of respect for a god humble enough to be our servant.

In early morning light, her handlers attend 60-year-old Chanchal Kali with all the respect due a matriarch.

By Thomas B. Allen

Bulletin boards of the 21st century are coming of age

People are learning that with a computer, a modem and a few bits of know-how, they can bring the whole world to their doorstep

The system operator, or "sysop" for short, runs his bulletin board with the fervor of an electronic lover.

I am making a telephone call by tapping the number keys—2775990—on my computer's keyboard. Somewhere, in another computer, a telephone rings. I hear a dial tone, then a high-pitched whine. On the screen of my computer monitor the word "CONNECTED" appears. And then: "Welcome to the EAST COAST PUB NET! A Free Information Exchange for Writers, Graphic Artists, Photographers, Editors, and Publishers. Enjoy." I log on in a simple ritual: in response to questions, I type my name, city and state, and a password that will enable me to call the board again and prove I am not an impostor. A computer-style menu pops up, and from Pub Net's offerings I select "conferences," which includes one called Writers, Editors and Other Word Mongers.

Pub Net, I am informed, allows conference members to contribute poems or (very) short stories—no longer than 99 lines. Keystroke by keystroke, I follow instructions to open the Pub Net anthology. In a few seconds I see this relaxed message: "O.K. folks here is using the conference for what it is intended."

By pushing the down-arrow key, I scroll through the torrent of words pouring onto the screen: a poem based on Greek myth, a surge of sonnets, a delicate strand of haiku, a kindly comment about the haiku from a conferee who identifies himself as Yukio Iura. He has a message for "ALL": we should know about Machi Tawara, a Japanese language teacher whose poetry booklet sells in the millions in Japan. He types: "Is it alright for you to say 'Marry me'/After drinking couple cans of beer . . .?"

Words, sometimes typed weeks before, linger in the nowhere place called an electronic bulletin board.

Yukio Iura is there and not there. His words, typed weeks before, linger in this nowhere place called an electronic bulletin board. He is reaching out to touch people by posting a modern version of the weather-beaten notices that fluttered on the wall of the old town hall.

The boards present messages and conferences on subjects as diverse as the whims of the human heart and mind. A sampler, from several hours of browsing: astronomy, comic books, motorcycles, skydiving, artificial intelligence, music, investments, medicine, mathematics and "harmless jokes." A New York City bulletin board offers conferences on such topics as aging, alcoholism, death, eating disorders and psychopathology.

I logged on to a discussion about transactional analysis: "Once this process begins (the re-writing of the life script), self-acceptance is soon to follow." The writer then veered off to say, "Whenever you discuss

Illustrations by John Huehnergarth

abstract ideas, they seem to float away into the clouds."

Abstract or not, the ideas kept bounding onto the board, and the phrases had the air of an academic discussion: "I'm not sure I understand your point fully" or "As you must realize" or "I *DO* think the topic is one that should be researched."

The analysts, like the Pub Net group, use the boards to exchange information through a medium that combines the convenience of the telephone with the massive memory of the personal computer. Many who use the bulletin board system—BBS to enthusiasts—believe that they have discovered a form of communication that can revolutionize the way we exchange information.

Yukio Iura puts his messages on boards like Pub Net. He also has his own board, which he runs with the zeal of a true believer. A Japanese banker who works for the Institute of International Finance in Washington, D.C., he says, "I see what I do as personal liaison between the United States and Japan."

On his board, Yukio discusses such subjects as Japanese culture and international economics. He runs as many as 21 conferences, exchanging messages and ideas with about 500 callers. I met him first on the boards—he frequents several in the Washington area—and then dialed his board and asked if we could meet in person, a rare event in the BBS world. In this world, people argue, chat and exchange information without hearing each other's voices, without ever seeing each other. They spend hours, usually at night, reading words, writing words, seeing ideas and thoughts scroll by, staring at their monitors, never at a human face.

"I like to know who is on my board," Yukio told me, "and so I ask them to register. When you register, I put your name on a kind of chart and I see how much you use my board. If you do not use it for two months, your name is dropped and you have to register again."

We met in his office, which overlooks Pennsylvania Avenue, a few blocks from the White House. In person, Yukio was as bright and courteous as his board, whose instructions are well sprinkled with "please" and "thank you." A computer sat on his neat desk. He often patted it when he talked about his other two computers at home.

As the custodian of a board, Yukio is a "sysop"—a system operator. A sysop sets the rules, deciding what a caller must do to log on, how long the caller can stay on and what the caller can take (or "download") from the board. "Some boards are very strict. Some even want a donation," he says. "My board is generous. I let a caller on for 60 minutes at a time and I let him download to almost the sky's the limit."

Callers can upload information from their computers to a board or download offerings from a board to the caller's computer. Many of the programs are the proud creations of highly talented hackers who want to show off their handiwork to appreciative peers. (A clock program I downloaded from Pub Net, for instance, replaces my computer's coldly precise digital time with a more human-sounding phrase. So instead of flashing, say, "12:08" on the screen, the computer gives the time as "A few minutes past twelve.")

"I do not have many techies on my board," Yukio says. (Techies are, as you might guess, technical whizzes who love to write and tinker with computer programs.) "My callers download documents much more than they do programs." Typical documents are bibliographies of Japanese writers available in English, a short biography of the poet Machi Tawara, and an essay by Yukio about consumerism in Japan.

A file called Trashcan enables a bulletin board to recognize problem users and promptly dump them.

Getting beyond many boards' restrictions to find out more about another conferee can be very difficult.

"My board," Yukio says, "is a way of saying thanks to Americans who taught me how to use computer technology. I feel that operation of a board is one of the best ways to show my appreciation." When he returns to Japan, he will leave the board to his successor. In Tokyo, he hopes to become the sysop of a bilingual BBS that will help to bring Japanese and American residents together.

A sysop, like someone behind a one-way mirror, is invisible but able to observe. Callers have no way of knowing whether the sysop is watching them or has gone off and left the board on automatic. A young Washington woman tells of having trouble downloading a program from a BBS. "All of a sudden," she recalls, "a message flashed on the screen. It addressed me by name and politely asked me if I could use some help. I felt like God was talking to me."

The message came from Kurt Riegel, director of national astronomy centers for the National Science Foundation and sysop of Astro, a board that informs callers about such celestial matters as the coming of comets and the cataloguing of stars. Astro attracts callers from throughout the United States and Europe. "And the other day," Kurt told me, "someone logged on from Brazil."

Kurt let me watch him in his sysop role one night at Astro headquarters—a room in his home on a quiet street in Arlington, Virginia. On the table before him were a computer, its monitor, a keyboard and a telephone, to which a device called a modem was connected. The rest of the table was cluttered with stacks of floppy disks and computer manuals.

A caller's modem (*mo* for modulation, *dem* for demodulation) changes, or modulates, the computer's letters and numbers into audible tones. The high-pitched, whistling tones are transmitted over telephone lines to Kurt's modem, which demodulates the signals. His computer then restores the signals to the original letters and numbers, which then appear on his monitor.

"I don't pay much attention to security," Kurt said. "And of course there is no way to check on whether someone is using his or her real name. But I do have this." As he spoke, he brought up on the screen a file called Trashcan, which contained a list of words that he, as sysop, had seen being used as caller aliases. There were the usual four-letter words, along with many others, including Alien, Darth, Oz, Starfleet and Psycho. "When the bulletin board sees anyone trying to register by using any of Trashcan's words," Kurt said, "the user is dumped and disconnected."

Kurt's fingers poked about the keyboard. "My job is primarily throwing away stuff. There's an unbelievable amount of junk." He scanned messages, deleting old ones and rearranging the rest of them.

Most Astro callers want to discuss serious topics. One, for example, asked a technical question about the way the Doppler shift could affect communication with extraterrestrials. Kurt responded with an equally technical answer. Incoming messages may be addressed to ALL, to the sysop, or privately to another registered caller. (One message looked at first like a report of a new supernova. A new star, "primarily pink in color," had been born to an astronomer and his wife.) The sysop sees all messages, including the private ones. About 20 percent of Astro's messages are private.

Callers to some boards can get privacy through

Logging on to a bulletin board and not taking part in a conference among other users is called "lurking."

Free-lance writer Thomas B. Allen is a former editor of National Geographic. *His book* War Games *is about the use of models at the Pentagon.*

A high degree of correlation exists between sci-fi fans and the users of electronic bulletin boards.

aliases. A few boards, particularly those that encourage freewheeling conferences, urge participants to cloak their identities. "Women use aliases quite often, for protection, I guess," says Mike Cuthbert, who runs a popular radio talk show in Washington, D.C. "'Mr. Spock' is a doctor, an obstetrician. I know of at least one other doctor who doesn't use his real name.

"I'm in a lot of boards—with my real name—and I get ideas for my shows. I like the boards. They give people a chance to talk without the usual hangups. There's usually no mention of body shape or questions about looks, and no 'Are you sexy?' We have fine conversations, especially on the more intellectual boards, where they chase away the techies."

Most forms of communication provide clues about the communicators. On radio, Mike Cuthbert's resonant voice is readily recognized. Pen pals can get clues from each other's handwriting. Strangers on a telephone can make geographical assumptions from drawl or psychological assumptions from intonations and pauses. Even Morse code senders have a recognizable touch. But board users get no reliable cues about each other's appearance, age, sex or background.

Michael Banks of Cincinnati, a science-fiction writer and editor, has spent numerous hours on-line, talking with BBSers or observing them by simply logging on to a board and not taking part in a conference. (The BBS word for this practice is "lurking.") He first became interested in the boards when he discovered a high degree of correlation between science-fiction fans and BBS users. At sci-fi conventions Banks sometimes meets people whose names he recognizes from having seen them on the boards. "But lots of times there is a reluctance about meeting," he says. "There is no real response. I know this will sound funny, but nobody—nobody—I have met comes off as I thought they would. The on-line people in person are not the way they are on the boards."

Shy as they may be, on-liners know how to speak up in their silent way. The Federal Communications Commission once proposed that a special access charge be added for "enhanced" uses of phone lines. The charge was clearly aimed at long-distance users of bulletin boards and electronic mail. Outraged COMPLAINTS and WARNINGS burst forth on the screens, as did form letters to be copied and sent off to members of Congress. "We were deluged," an FCC lawyer recalls. "My son is a hacker, and I heard a lot about that proposal. Believe me, it is absolutely dead."

Because the on-line world is rarely organized and always invisible, information about it is hard to come by. But its growth is known to be phenomenal. One of the most extensive systems of bulletin boards is called FidoNet. In 1984 it consisted of 300 boards; by 1987 there were 2,000 in a network encompassing Europe, Asia, Africa, South America and Australia.

I asked D. Thomas Mack, the man most responsible for founding the bulletin board world, how many boards are on-line at any given hour. "Probably in the five years that electronic bulletin boards have been out there, I'd say there have been anywhere from 50,000 to 100,000 boards," he told me. "But if you ask me how

Violent language is called "flaming"; one board has a conference called Flamers/Get Rid of Your Anger.

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When bulletin board users actually meet in person, says one, "nobody comes off as I thought they would."

many are currently operating, I would say anywhere from 1,000 to 5,000.

"Boards are like wives, dogs and swimming pools" he continued. "Everyone has one once. And so people put up a bulletin board to see what will happen. They fail to see that it will take a lot of time. The maintenance of a board, like the maintenance of a pool or a dog or a marriage, gets too much for them and they quit."

Mack, a General Electric executive who lives in Trumbull, Connecticut, says that for him, running a board has added a 40-hour volunteer workweek to his 40-hour work-for-pay week. (The license plate on his wife's car is PC WIDOW.) Mack speaks of boards in religious terms: "Everyone gives a little something back to the world. I decided not to be active in my church or in my community. I just do RBBS."

Mack created RBBS-PC (Remote Bulletin Board System-Personal Computer), a popular software program for connecting computers through telephones and modems. Without RBBS-PC or a program like it, bulletin board communication is not possible. Mack distributes RBBS without charge because he believes that a bulletin board is "a contribution to a community, just like a barn raising was. It's a 21st-century technology that's grounded in the concept of user helping user."

Mack gives credit to a Chicago board, begun around 1978, as the predecessor of today's BBSes. In those days, boards were connected with each other in various makeshift ways. Then in 1983 Mack began working on a bulletin board program that would enable people in many places to exchange information quickly and accurately. The result was RBBS-PC, which continually clones itself by the simple process of getting uploaded into one computer and then downloaded into others.

"Unlike radio, newspapers and television, RBBS-PC provides a vehicle within which information can be exchanged! That is what makes RBBS-PC so unique," Mack wrote in a commentary accompanying downloaded versions of the program. "Because the exchange is written, it is structured. Because it is structured, it can be thoughtful. . . . RBBS-PC provides every personal computer owner with his own 'soap-box' in a national Hyde Park."

But BBS users tend to cluster around local phone numbers, as in a neighborhood park, rather than spending money to dial distant boards. So local sysops usually compile long lists of area BBS phone numbers and offer them for downloading. Often, though, the numbers produce not a modem's whine but a human one—an irate voice saying the household no longer includes a BBS. Or the number may be answered by a cheery phone-company recording that says the phone has been disconnected.

On these short-lived chatter boards, as serious computer communicators call them, the screen pulsates with short messages, sometimes in lowercase, sometimes in PASSIONATE CAPITAL LETTERS. The sentences slam into each other as each person types a comment and the squabbling scrolls down the screen. When an antifeminist broke into a conference on

Kids on a national BBS network share information and occasionally discuss culinary tastes with one another.

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On an international level, scientists in the United States and the Soviet Union have set up a bulletin board to compare notes on global warming trends. They can communicate without the expense or protocol problems of face-to-face meetings in either country.

women's rights, a woman typed her response, then sputtered: "My computer is smoking."

Extremely violent language is called "flaming." One board has a regular conference called Flamers/Get Rid of Your Anger. Because of the lack of visual or audible cues, emotional BBSers must resort to symbols. In a good mood, they will add a signal for a smile—or type "tee-hee" or "grin" or "hug." When flaming flares, however, they will INSULT EACH OTHER IN CAPITALS.

Most inhabitants of the BBS world want to exchange information, not insults. Typical callers roam the boards—BBSing, they call it—not to lurk but to upload and download. There is an understanding among the program swappers that those who take must also give.

Many sysops keep track of "download/upload ratios" and chide program hogs for monopolizing online time; it may take half an hour or more to download a long program. Harassed sysops, who combine the virtues of a drill sergeant and a favorite auntie, must ration users. Complex rules govern access to the most popular, program-laden boards.

Some BBSes are strictly private; only registered callers, using passwords, can log on. Commercial information-service boards, which are not considered part of the BBS network, charge subscribers for the downloading of information, such as stock-market prices, airline schedules, or copyrighted data bases.

Uncle Sam is the sysop of a surprising number of boards. I lurked on BBSes at the Department of Commerce, the Census Bureau, the Department of Education and many other agencies on U.S. Government lists. Imagine my surprise when I dialed the U.S. Bureau of Prisons and was told: "If you have accidentally found this board and are not a government employee or other authorized visitor, you are NOT welcome here! REPEATED LOG-ON TRIES WILL BE REPORTED TO LAW ENFORCEMENT AUTHORITIES!!!" Talk about flaming!

I did receive permission (and a short-term password) from the Defense Mapping Agency to dial the somewhat restricted board operated by the DMA's Navigation Information Network. After a few keystrokes, "PIRATES"—yes, in capitals—appeared.

The warning involved the West German ship *Urundi*, which "was attacked by pirates while dropping anchor in Freetown harbor, Sierra Leone. The pirates, who were armed with knives and axes, climbed on board the ship after approaching it on a motorboat, smashed in 6 containers, and stole some goods. The captain of the *Urundi* . . . took the attackers by surprise and they fled."

This electronic advice to mariners is an example of how BBSes are rapidly spreading from the PC world of hackers and other hobbyists to the world at large, where the PC-phone-modem hookup is gaining new

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In this world, people spend hours, usually at night, staring into their monitors, never at a human face.

respect. Just as the U.S. Government is reaching out with this latest form of communication, so are states and cities.

In Cleveland, the Society for Public Access Computing was formed in 1987 to help found "Electronic Cities," a community computing system. The pioneering system was founded in Cleveland by Dr. Thomas Grundner, who is a faculty member at Case Western Reserve University.

Responding to simple computer commands, the visitor to "Electronic Cleveland" signs a guest book and wanders through the city, choosing such stops as Government House, University Circle, the Post Office, the Hospital, the Schoolhouse, the Arts Center and the Courthouse. Each stop offers interactive communication and information about what is going on at the real-world version of the electronic way station. Government House was still being built when I entered. The blueprint calls for a system that will let the online citizen log on to "electronic offices" of local, state and federal elected representatives. In each office the visitor will be able to download a newsletter and leave messages in a mailbox.

On an international level, scientists in the United States and the Soviet Union have set up a bulletin board network to compare notes on global warming trends. This streamlined technology makes it possible for American scientists to communicate with their Soviet colleagues without the expense or protocol problems of face-to-face meetings in either country.

Classrooms are also going on-line. A growing number of schools—plans are for as many as 10,000—are linked through the National Geographic Kids Network, a collaboration of the National Geographic Society, the National Science Foundation, and Technical Education Research Centers of Cambridge, Massachusetts. Late last year a field test of the network dispatched pupils of 31 schools to ponds and creeks from Massachusetts to California. The kids, from fourth through sixth grade, then tested the water for acidity and typed their findings into the network to compare results. A scientist at a central computer analyzed the data, put the information into map and chart form, and then uploaded the results back into the network.

Megan Andrew, of the North Dickinson Elementary School in Carlisle, Pennsylvania, was shocked at what appeared on her classroom monitor. "The worst," she said, "was finding out that we had the most acid in our rain and it is going to kill the fish."

Sometimes the youngsters on the network just talk to each other. "I'm the only kid in my class that lives on a farm," a fourth-grader typed. ". . . I've been living on the farm all my life. My favorite food is sweet corn. I hate peas."

From a fifth-grader: "We live in a small town about two hours away from Richmond, our capital. There are about 400 kids in our school. The food in our cafeteria is terrible."

Networked kids discuss classroom pets

And at an on-line school in Massachusetts: "We had a discussion on whether or not to include Kirsten's antfarm as a pet. Shauna said it wasn't, because the ants do not share our environment. Then, we wondered if we should include the fish. We took a vote of the whole class before we decided that the antfarm was not a pet."

Farther up the electronic street is the New School for Social Research's Connected Education Program. Students do not go to the New School's New York City campus. They stay home and dial up a bulletin board that presents lectures and assignments. They can log on to lectures such as "Artificial Intelligence and Real Life," type questions, and get responses from other students and lecturers.

On-line computer classmates can drop in at the Connect Ed Cafe, where they electronically socialize with other students and faculty members. They can also go to a computer library to read or print out

computer-stored documents written by Connect Ed faculty members and visiting lecturers.

For the foreign students—they dial in from Europe, Japan and Singapore—there is Connect Ed's on-line tutoring in written English as a second language. And for prospective graduates there are conferences on jobs, including ones involving computer networks.

Seminar members—there may be as many as 25—read the faculty member's launching comments, write comments of their own and then discuss the topic with one another. Unlike off-line students who file into a lecture hall and listen, on-line students can absorb their professor's words at any time they want and from anywhere they happen to be.

Paul Levinson, the founder of Connected Education, is a member of the New School's faculty and an associate professor of communications at Fairleigh Dickinson University. A major advantage of what he calls "Electures," Levinson says, is the students' ability to participate "when they are at their best" and without "the anxieties that occur in face-to-face groups." He believes that computer conferences may greatly help the shy ones who do not perform well in the classroom.

"Fingers fluttering lightly on keyboards in the privacy and convenience of homes," Levinson writes in his book *Mind at Large*, "may be more faithful servants of the intellect than tongues wagging in smoke-filled restaurants and crowded halls."

I lurked at the Connect Ed Cafe a couple of times and listened in on conversations. People did not RAISE THEIR VOICES. The talk was civilized and reminiscent of countless conversations in countless colleges over countless years. There were solemn discussions about the state of the Universe, the meaning of reality and the search for absolute truth. Wistfully, I wished I were there. And then I suddenly realized that, electronically, I *was* there. This was a nowhere place and, as part of it, I could be anywhere.

Bulletin board subjects run the gamut. A sampler from a few hours of browsing: astronomy, comic books, medicine, skydiving, music, investments, artificial intelligence, mathematics and "harmless jokes."

THE MERCEDES-BENZ 300 CLASS: ITS TECHNOLOGY MAY BOGGLE THE MIND, BUT THE SOUL UNDERSTANDS IMMEDIATELY.

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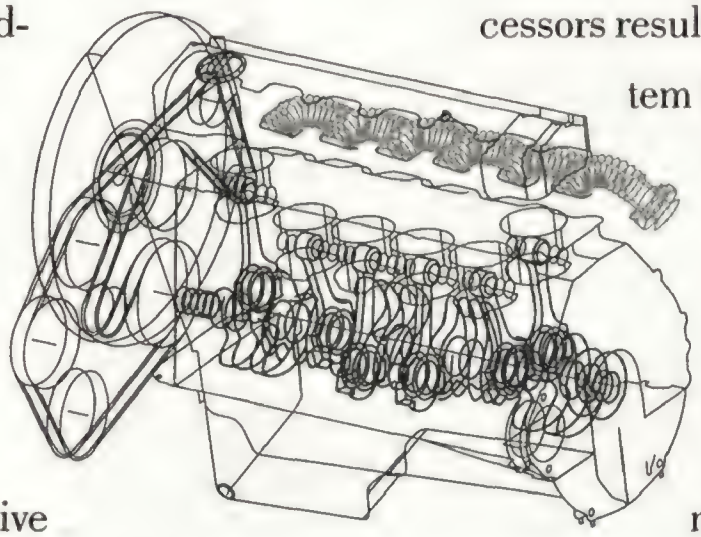

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In Albuquerque, letter carrier Kathy Romero wheels a cart piled high with day's mail to her waiting van.

By Jake Page

One in 500 million: tracking a letter across the country

A curious postal patron follows his own letter from Virginia to New Mexico and finds there's still no substitute for the human eye and hand

It will take her six hours to deliver 3,000 pieces of mail to the 492 stops along her ten-mile route.

My post office consists of three rented rooms in an early 19th-century building in the center of town, the town being a place of fewer than a hundred families, five businesses and no street addresses. There are about 160 mailboxes along the outlying rural roads and that completes this Northern Virginia ZIP Code. Small potatoes.

In the public room of the post office are a wooden bench, two metal wastebaskets and two walls of brass mailboxes with little windows and combination locks. The locks are worn down by several generations of twirling and they sometimes get cranky—at least mine does occasionally, requiring a retwirling or two before it lets me in. It is here at about 9:45 in the morning six days a week that I ritually go to see what the rest of the world has sent me.

Sometimes there isn't much in there—a few forlorn appeals, perhaps, or a cheerful newsletter from my congressman. Other days, the box can be a cornucopia—magazines, news from children and friends, maybe even a check. I am lucky: only once in eight years was there nothing in my mailbox. That day, of the 500 million pieces of mail that reached their destinations in the United States of America, none came my way. Nothing. I went home and wrote eight letters in a panicky effort to reconnect myself to the world.

Sifting junk mail for pleasure and profit

People tend to take their mail—and even their mailboxes—personally. Many find their privacy somehow invaded by the sheaves of direct-mail appeals that regularly arrive unasked. I happen to be a fan of what so many people disparagingly refer to as junk mail. It is perfectly easy to throw away, after all, and it is often amusing, depending on one's mood. The arrival of a catalog of arcane tools sets my mind to work, dreaming of arcane projects that would fit the tools. The tools are rarely ordered, the projects rarely done—but dreams are important. I hear about new books, new bird feeders guaranteed to be squirrel-proof, and exciting possibilities in investments and real estate. Like most of its readers, I subscribed to SMITHSONIAN by virtue of a piece of direct mail. Still, many people grumble about such arrivals, although no one I've ever heard of blames this on the typically friendly clerk who puts your mail in your personal box. Conversely, we all assume that there are conveniently located letter carriers who, with similar attentiveness, deliver the letter we write. Without thinking about it much, we imagine brigades of people in between, moving "our" mail along its prescribed course, faithfully heeding such imprecations as FRAGILE or DO NOT BEND, and presciently decoding our handwriting.

But when the system breaks down—when, for example, a letter takes too many days to arrive—all those people in between turn immediately into gnomes inhabiting dark rooms, some listlessly dropping our letters on the floor while others operate clever package-mangling machines, pausing only to giggle at the inanity of the messages we wrote on postcards. Could this be?

So one day I wrote a letter to a friend in Albuquerque. The experimental letter might have been sent to some remote town in Alaska, possibly involving dog sleds at the other end, or some other fearfully difficult destination requiring heroic actions, but that was not the point. I wanted to see what happened to an ordi-

Photographs by Cameron Davidson

Tracking a letter across the country

Postmaster Norris Beavers of Waterford, Virginia, receives the author's "red letter" for Albuquerque.

nary letter going to a normal place (although I understand that many people in the United States don't know that New Mexico is part of this nation). I carefully typed the address and ZIP Code and affixed a stamp. At about 4:30 in the afternoon, I took the letter down to the post office and gave it to Norris Beavers (below), our postmaster and the only full-time employee in the place. Norris is aided by Betty Hutchison several days a week, and on Saturdays—Norris' day off—she acts as postmaster. Yes, postmaster, not postmistress. Women who serve in this capacity are masters, I had found. By this time I had also found that Norris was one of 28,000 postmasters and that the U.S. Postal Service's brigades number 633,387 (with part-timers and temporaries, 800,000), making it the nation's largest civilian employer, ahead of General Motors and other behemoths. As well, I knew that my friend's mailbox in Albuquerque was one of the 96 million in this country to which on any given day the mail must be delivered.

Bemused by the odds, I told Norris that I was curious about what would happen to my letter during its voyage and, an affable man, he invited me into the back room, which for eight years I had only glimpsed through the customer-service windows. He cautioned me that it would be inappropriate to look too closely into my neighbors' mail slots.

"The mail is privileged," he said.

This, then, is the tale of my letter—for these purposes, a kind of Everyletter.

Behind the scenes in a country post office

Norris glanced at the ZIP Code and told me that it would take three days to get there. Overnight service is standard for any place within about a hundred miles. East of the Mississippi takes two days; farther west is targeted for three-day delivery. Along with a handful of other envelopes, Norris ran my letter through a device that looks like an antique sewing machine, made long ago, but made no longer, by Pitney-Bowes: the Universal Canceling Machine.

Everyletter joined others in a two-foot-long cardboard tray which bore a label that said DIS No Va 220 (its intermediate destination) and FCM (its identity—first-class mail). In the next half-hour, Norris canceled more late-arriving mail; put it into appropriate trays, boxes and bags; took down the American flag outside the post office; filled out the day's bank deposit; discussed the exigencies of the state motor-vehicle department with an evidently oppressed citizen of the town; and at 5:05 opened the door for two men who hauled all the outgoing mail to a van and drove it to a larger post office in the county seat four miles away.

By this time, Everyletter was as indistinguishable to a casual observer as a drop of water in a small stream.

Once in the post office at the county seat, it intermingled with yet other mail from other outlying towns and from there it all went to DIS No Va 220, which is shorthand for the Northern Virginia Management Sectional Center, located about an hour away in a place called Merrifield. The center houses a standard post office but it is chiefly devoted to processing the region's mail—about five million pieces a day. The building takes up six acres and is fed by 86 local post offices and about 1,600 other collection points. In addition, it regurgitates mail to nearly two million people in the region at a half-million delivery points, not to mention mail headed for such places as Albuquerque.

The tributary that included Everyletter arrived at Merrifield at approximately 6:30 P.M., along with most of the rest of the area's mail. Meantime, mail from outside the region was also coming in. The center, thus, must act like an enormous heart, taking in and pushing out all the region's mail as well as absorbing and sending forth all the mail arriving from elsewhere. An endless pulsating.

The mayhem would have pleased Dante

Inside the building there was seeming chaos: bags and bags of mail being dumped here and there; avalanches of odd-sized packages; rows of dollies loaded with magazines; a phantasmagoria of ramps and tracks of spinning rollers, unsorted letters flopping along, with robotic rubber disks flipping and separating them; hordes of men and women pushing carts and gurneys, dumping bags, hovering over the cascades of mail as they whisked past—and a great noise of people and machinery. Everyletter was quite obviously lost. It was mayhem, pure and simple: Dante would have reveled.

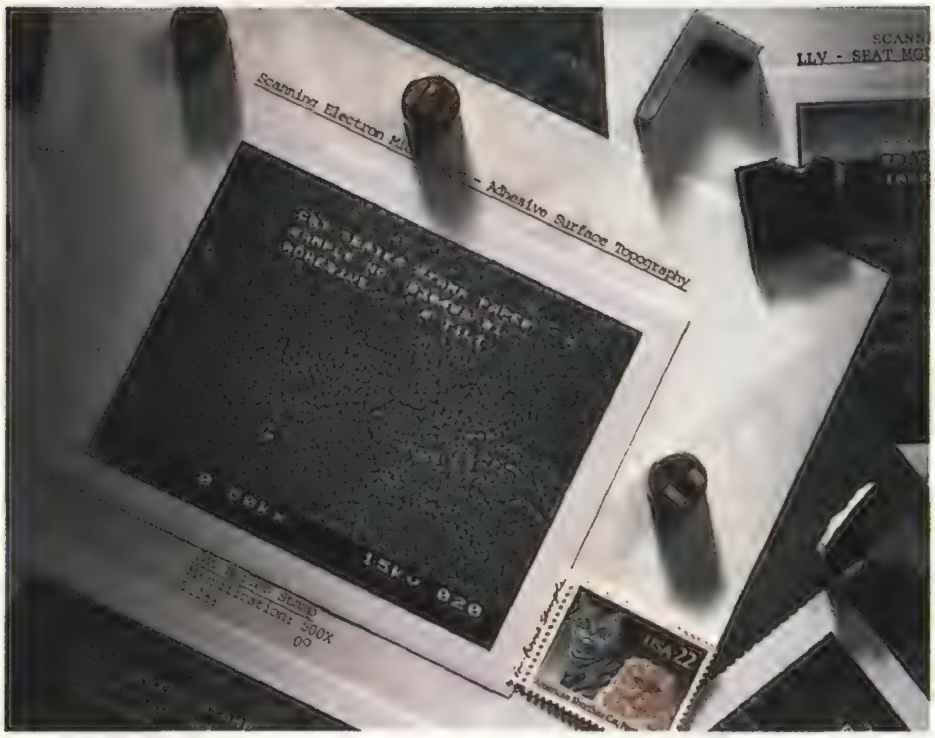
My guide, Jim Gillespie, explained to me what was happening. My letter had already avoided one fate, thanks to the fact that Norris had run it through his Universal Canceling Machine. Had he not done so, Everyletter would have been fed into the maw of a machine that "faces" letters and then cancels them. This machine looks at each envelope that goes through—at a rate of 30,000 per hour—and seeks out the stamp. If it doesn't find the stamp, the envelope is automatically turned over or around until it faces the right way and the stamp can be seen (the machine sees it because the stamp is phosphorescent).

In the Postal Service, they think of a stamp as a sandwich, the ingredients of which are paper, glue, ink, varnish and a phosphorescent substance. They sell about 35 billion of these sandwiches a year, sufficient to circle the Earth 22 times. Lately, thanks to research carried out at the Postal Service's Engineering Support Center next door at Merrifield, they are mixing the phosphorescent material directly into the paper. Mixed

Beavers starts the day by raising the flag; one of them flies outside every post office across the United States.

Inside, he sorts the daily mail into 217 slots. Betty Hutchison, a part-time clerk, opens a bag behind him.

The red letter goes through a manual machine that cancels the stamp, prints the date, town and ZIP Code.



At Postal Service laboratory, a scanning electron micrograph reveals improperly dried glue on stamp.

At a sectional center, letters whose addresses cannot be read go into bins like these, for sorting by hand.

The Merrifield, Virginia, center, one of 400 across the nation, handles five million pieces of mail a day.

with the varnish and added later, it doesn't glow as brightly or as uniformly. The glue is just as important: if the stamp doesn't adhere well—if the corners stick up—it might snare another letter racing along in the 30,000-per-hour blur, and that means handwork. In the center's chemical laboratory there is a scanning electron microscope that they use to spot-check the glue on stamps. Magnified 500 times, glue shows up as globules. If the globules aren't just the right size, the laboratory tells the glue supplier to shape up. Recently, the stamps with two cats adorning them had what the lab's manager, Joe Peng, along with some outspoken members of the public, found to be a foul taste. Stamps are supposed to taste bland, so Peng checked them out on the scanning electron microscope and, sure enough, he found that the globules were far too big: the supplier had not spent enough time in the drying process.

In the fall of 1988, the Postal Service will introduce the self-adhesive stamp, to the joy of those who hate licking stamps, bland-tasting or otherwise. They will cost the Postal Service an estimated $7 per thousand to produce, a large increase over the $3-per-thousand average, but they won't cost me any more. They will produce savings for the Postal Service that more than offset the cost. Self-adhesive stamps will be much less likely than licked ones to have a corner sticking up, thus jamming or otherwise slowing the automated processes that more and more are the name of the game.

Back in the Merrifield inferno, once the machine locates the stamp it cancels it with lines of black ink,

Jake Page has written for SMITHSONIAN *this year on the Great Oaks Vocational Schools in Ohio and on biologists establishing preserves in the Amazon.*

Through the seeming chaos in this six-acre building, the mail to and from two million people flows each day.

Optical scanner checks city and state against ZIP Code, sprays a bar code used by sorting machines.

and at the same time prints the postmark. Joe Peng also pays a lot of attention to the ink used for canceling because of a form of skulduggery called laundering, a $50-million-a-year business. Illegal agencies wash the cancel marks off stamps and then use them in highly profitable mailing services for unsuspecting companies. A few years ago, the Postal Service ended one such operation in Chicago—by itself a multimillion-dollar-a-year scam. So for canceling, Peng's laboratory has developed a new ink, the properties of which he will not reveal, that renders such larcenous meddling impossible. "This cannot happen anymore," he says with the happy grin of a man who has achieved revenge.

Once it's canceled—and now canceled for good—the next place a letter goes, and where Everyletter has already gone, is to a vast, long machine called an optical character reader, the first task of which is to reject a lot of mail: letters with handwritten addresses, for example, that have slipped though the winnowing process. Nothing thicker than a quarter-inch can enter. Some direct-mail envelopes are so fancifully decorated that they obscure the address and confuse the machine; out they go.

Again at a rate of about 30,000 an hour, the letters race by and the machine instantaneously reads the ZIP Code, the city and state, checking one against the other in its electronic registry. If they check out, it sprays a bar code—small vertical gray lines—on the envelope. Then, a bar-code sorter shunts each letter off into one of 96 or so bins, each bin for a different destination. One bin could be for Ohio, another for a place as little as my town, all depending on the needs of the hour. New multiline optical character readers are already being put in place; they can read an entire address and

People read addresses that machines can't, hit first three numbers of ZIP; letter is whisked to correct bin.

So far, so good: mail for Albuquerque is bagged and ready. Bar code gives the airline, flight number.

spray forth a bar code that stands for a nine-digit ZIP—in other words, they will have the capacity to sort the mail down to the level of exactly what goes into some distant mail carrier's bag. The advantage? Money, of course, in terms of limiting the number of times a human hand touches a piece of mail, but the major advantage is time. "We are always fighting the hours," says Jim Gillespie.

Had Everyletter not made it through the optical character reader for one sin or another, it would have been delivered as part of a great heap to a letter-sorting machine. While clever, this apparatus is comparatively low-tech, needing many humans to make it function. Twelve people sit at consoles while the mail goes past at a rate of one piece per second, a separate stream for each console. The people read ZIP Codes and key them in (the first three numbers usually suffice), and the machine, taking it from there, whisks the letters off to appropriate bins. On a six-acre work floor that seems as impersonal and anonymous as a parade ground, it is the operators of these consoles who are allowed to personalize their space. One array of consoles was labeled "Dream Machine." Some of the operators wear headphones tuned to one of three radio stations to drown out the noise. Periodically each operator is relieved, the reliever gliding into the seat with balletic grace, rarely missing a letter in the process.

But of course, letters do get missed. On the other side of the machine, where the bins are, one finds bins labeled "Nixies" and "Doubles." Doubles are when two envelopes get tangled up together. Nixies are letters the operators couldn't read. Gillespie pulled out a Nixie at random. It had a barely transparent window under which the address looked like a smudge. He shook his head with the air of a schoolteacher presiding over a class of slow learners. "It's amazing what

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More mail for Albuquerque rides up into the hold of an airliner at Dulles airport in Northern Virginia.

In chamber that looks like a coffin, postbox is bathed in salt steam to find out how it resists corrosion.

people—even large mailers—put in the mails," he said.

Once a letter has achieved the shameful status of Nixie, there is nothing for it but handwork. It is sent elsewhere and painstakingly handsorted, a process that will almost certainly add a day, if not two, to its journey. (A letter that comes in uncanceled and has to be routed first to the canceling machine can lose three hours for the extra step. This delay can mean it will miss its flight and thus will lose a whole day.) On occasion you will find a Day-Glo dot affixed to a letter you receive. This signifies that it was a Nixie.

The hidden meanings of those colored dots

After the mail has been sorted, the clerks put it into bundles; on the top envelope they stick another kind of colored dot. A bright pink dot imprinted with the letter A means that this bundle can go to, say, Buffalo, and more specifically to ZIP Codes 140 through 149. An orange D means that the bundle is for one five-digit ZIP Code; a green 3 means a single sectional-center facility; a blue F indicates that it goes to a single business address.

No matter how it is sorted—by hand or machine—a letter is collected by hand from the bins and winds up in a bag or on large trays. Cost-effective ways of mechanizing these steps remain elusive. Everyletter went into a bag that was earmarked for Albuquerque by means of a black-and-white label bearing the letters ABQ, just like a baggage-claim ticket, and a large, bold bar code that indicated what flight of which airline would carry it. This bar code was read automatically while the bag was weighed, thus letting the Postal Service know what it owed the airline. Most U.S. mail is contracted out to commercial airlines, so one's letter is subject to the same vagaries that affect any airline passenger or piece of luggage. The Postal Service pays nearly a billion dollars a year to commercial airlines for carrying the mail, and recently it contracted with Evergreen International Airlines, a private air-cargo service, to provide a network linking 23 cities exclusively for the delivery of mail. The new system uses Terre Haute, Indiana, as its hub. It won't replace nighttime commercial airline transport of the mails, but it will augment it, and provide added flexibility and control in scheduling.

The schedule went well for Everyletter. Twenty-four hours after it was mailed it was in Albuquerque, somewhere on the floor of a far-smaller counterpart of the Northern Virginia Management Sectional Center. (More people live in the Virginia suburbs of Washington than in all of New Mexico.) Once again that evening, on Tour One—the shift that begins at 10 P.M.—my letter went through a bar-code sorter and was automatically whisked into a bin labeled 235.

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After a day in transit, the author's letter arrives in Albuquerque, where Romero puts it in correct slot.

Romero loads for a day of "park and loop": lock her van, walk up one side of the street, down the other.

Eventually someone collected the mail from bin 235 and wheeled it on a gurney into a large room off the main floor. Around the walls were 24 stations, three-sided carrels lined with mail slots, each slot corresponding to an address. One of these stations was labeled 235, the route of a letter carrier named Kathy Romero. One of the slots at her station corresponded to the address of my friend.

At about 5 in the morning, Kathy Romero's supervisor, Ricardo Valenzuela, arrived and surveyed the great pile in the middle of the room, gauging its amount and determining if extra hands might be needed. "It's like a game every day," he said. "We have to have the strategy and timing to win."

At 6, Romero arrived along with the other carriers. The mail for her route, all arranged in cardboard trays, was wheeled over to her station. She proceeded to sort it into 500 slots, about ten running feet of mail (which is two-thirds of the average daily amount that arrives in my post office in Virginia). Romero is a soft-spoken, diminutive woman and she finds the two or three hours of sorting the mail "a sociable time." There is a good deal of friendly chatter among the carriers around the perimeter of the room.

Nearby, a man was staring thoughtfully at an empty station. He was Joey Gutierrez, formerly a letter carrier, now on special duty to work out a new route. It is an art: even computers have trouble finding the shortest route for a traveling salesman. Gutierrez was analyzing the geography, looking for an efficient order of stops. As part of the job, he would have to sell people along the new route on the idea of Neighborhood Delivery and Collection Box Units, a cluster of mailboxes mounted on a pedestal anchored outdoors on the sidewalk. They can cut hours of delivery time, thus expanding a carrier's route, he explained, "but they also are best for security. They're locked so no one can take away anyone's checks or food stamps." He talked of the "sanctity of the mails."

By 9, Kathy Romero was nearly finished sorting her mail. She held up an envelope and pointed to the address. "The suite number is wrong on this. I know; I've been on this route three years. Technically, I could return this to the sender, but what good would that do? Just slow things down." It went into a slot.

Shortly after, she pulled all the mail from the slots, put it in cardboard trays, loaded it on a gurney and wheeled it outside to a parking lot where her vehicle, a squarish white van, sat waiting. It is called a Long-life Vehicle and Romero doesn't like it much. "I'd gotten used to my Jeep. This thing is so big," she said. "I suppose I'll get used to it."

Back in the Engineering Support Center, they have a few Long-life Vehicles in stock. The center's administrative manager, John Hunter, had showed me how they were working on the air-circulation system; at the time, hot air from the engine was blowing right into the driver's face. Also, for security purposes, there is no back window. That means the carrier in the driver's seat can't see if a child is standing or has fallen directly behind the truck. So the center's engineers were working up the specifications for an additional rear-view mirror that would become standard equipment.

Out on the streets of Albuquerque in her Long-life Vehicle, Romero explained that, over all, her route is about ten miles long and that she does half of it on foot. There is just one "mounted stop," meaning a place where she only needs to drive up and lean out the window to deliver the mail. For all the rest, she drives to a strategic spot, stops, takes the mail out and locks the truck. Then it's up one side of the street, down the other and back into the truck. In most cases,

she has to walk up a path to the houses: "I don't ever cut across people's lawns." When she got to one of the few cluster boxes on her route, it took only 45 seconds to deliver the mail for ten people. (The engineers back in Merrifield torture each model of these cluster boxes, putting them in showers to see if the mail stays dry. They spray salt water on the familiar, blue postboxes and subject them to desertlike heat. They set fire to various types of private mailboxes. All such efforts are to see if the equipment is worthy of approval by the U.S. Postmaster General. No mail will be delivered to a box that has not received this approval.)

Along Romero's route, a local hairdresser waved from his car, shouting to remind her of her appointment later that day. Everyone was happy to see her.

"You get to know quite a bit about the people on your route," she said. "I know when someone's having trouble paying the bills, when there's a divorce, a death. One couple shares a birthday. They get such a big stack of mail that day that they're almost embarrassed. And we keep track of old people, or sick people. If someone doesn't collect their mail for a few days, I tell my supervisor and he has someone check and see if they're OK."

Romero spoke of the worst things that can happen to a letter carrier. One is a traffic accident. Even a near accident gives her nightmares. Another item on the horror list is being attacked by a dog. (The Postal Service keeps track of such things: in 1987, there were 3,346 letter carriers attacked by dogs.) Kathy Romero is never without her standard-issue can of Halt (cayenne pepper in a mineral water solution), "a lifesaver," she said.

An unhappy customer is a minor tragedy in her life. "A lot of people get very upset if you put someone else's mail in their box," she explained.

Having begun at 6 and having hit the streets at 9:30, Kathy Romero would finish her route some time around 3. As it turned out, Everyletter arrived at its address at 11:05, a day early. After being sucked into the great vortex at Merrifield, then winnowed out of the maelstrom, it emerged from the ceaseless, omnidirectional migration of the mails, reaching its destination in 42 hours 35 minutes.

It cost a quarter.

A full day early, the red letter from Waterford is tucked safely into the proper mailbox in Albuquerque.

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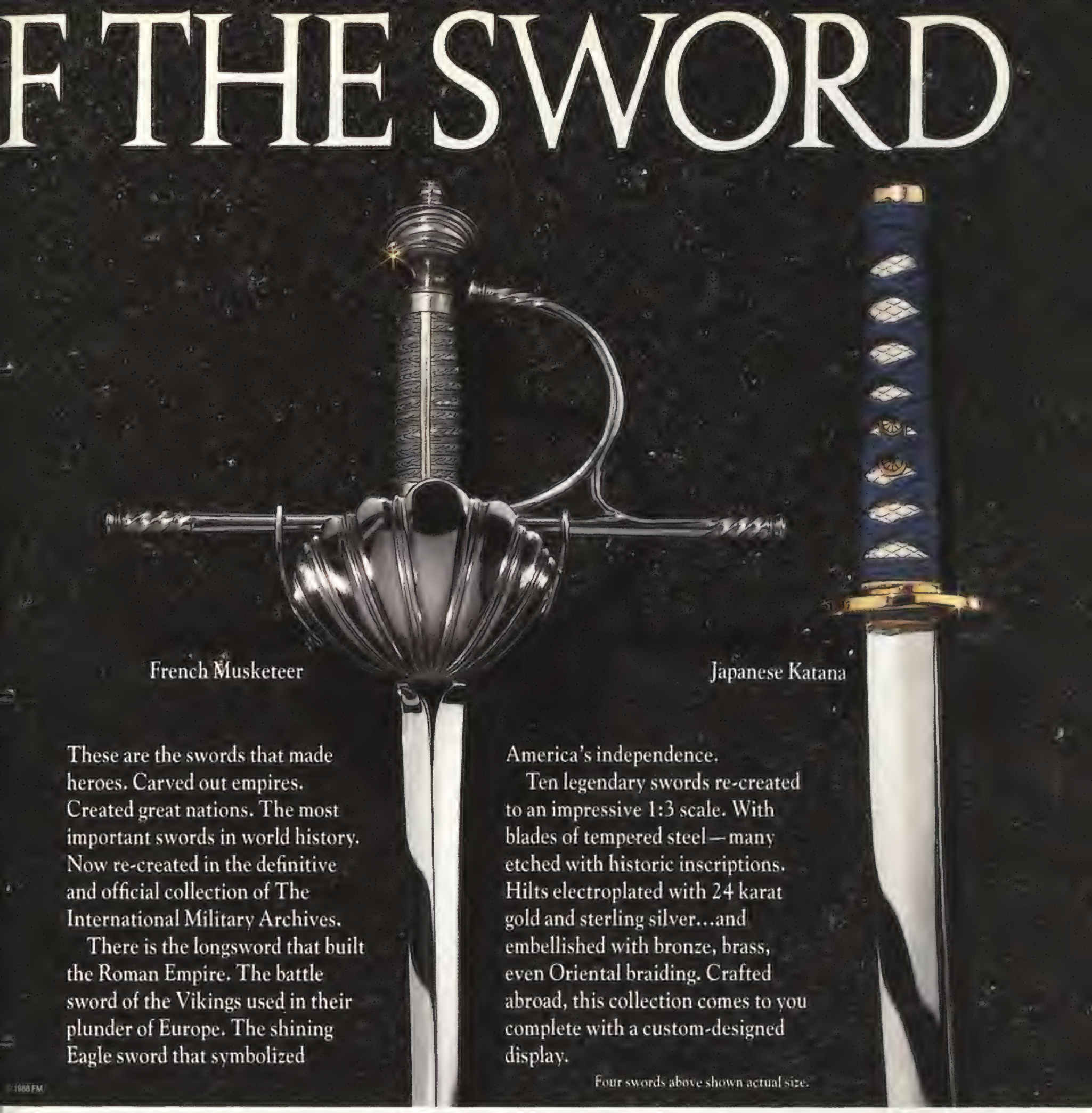

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Giacometti, at 63, emerges from Montparnasse studio, his home for 40 years. "The longer I stayed, the larger it grew," he once said. Amenities were at a bare minimum; it was the work that counted.

By Israel Shenker

A driven artist's lifetime of jousting with the void

At work, Alberto Giacometti cried: 'It's no good. I have to give it up! It's useless. I'll never manage.' But manage he did

Alberto Giacometti was the sculptor who reduced the human figure to essentials, and then went on to remove some of them.

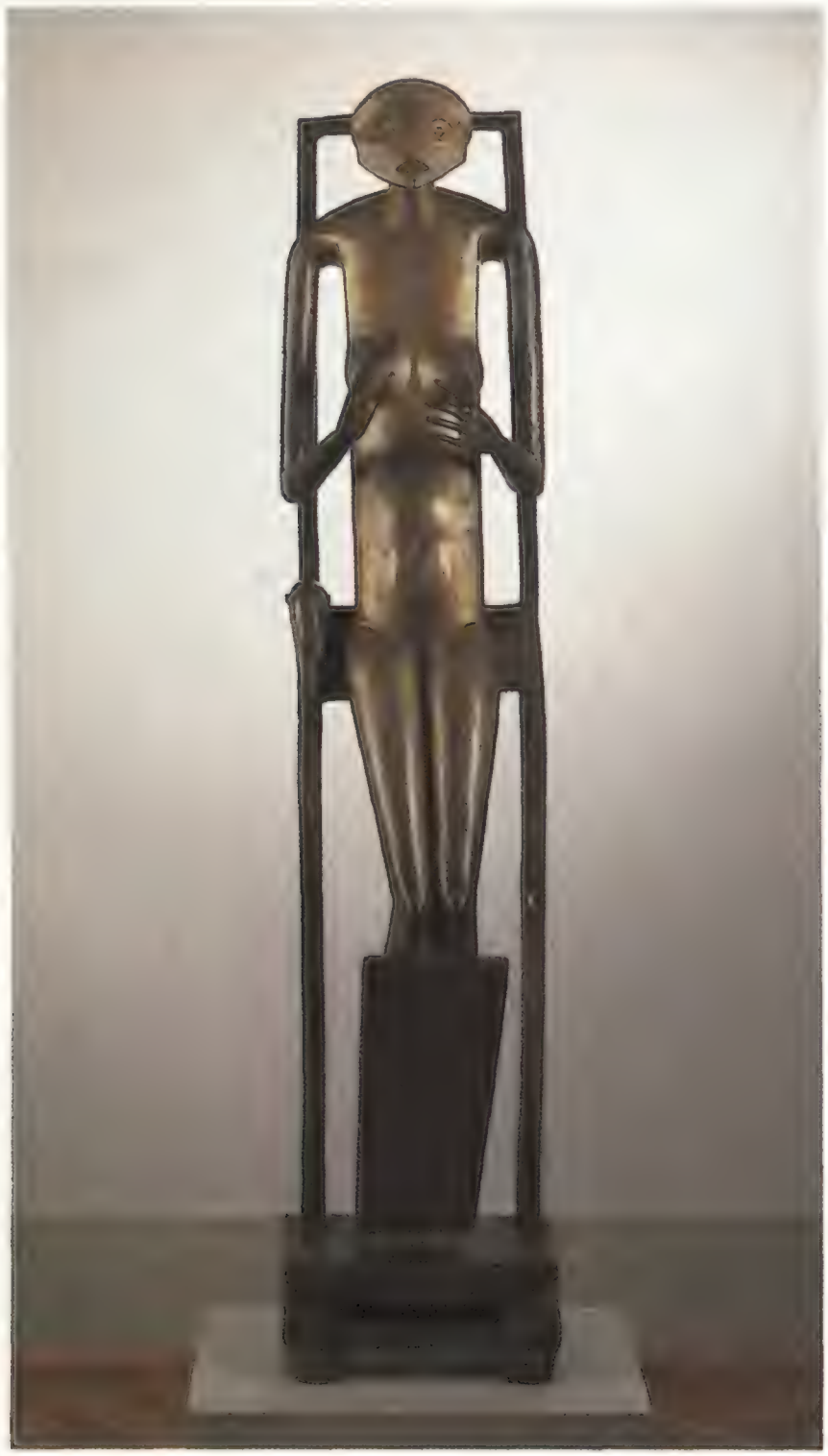
He arrived with the first year of the 20th century, and his statues posed a challenge to the art that had gone before, defying the conventions of vision and eventually the very notion of dimension. Scraping away at solidity to create the void, he got nowhere, but slowly, with infinite pain, obsessed by self-doubt, complaining that his task was impossible. The works were will-o'-the-wisps, spindly lengths of plaster strung out to mimic Man—splinter-thin, accretive monsters standing, walking, falling lonely, the long and short of them overcoming their breadth. In the wake of Impressionism and Expressionism, Giacometti was founding father of Immaterialism.

Some of his more accomplished offspring—about 50 sculptures, 30 paintings and 25 drawings—have come together for a family reunion at Smithsonian's Hirshhorn Museum and Sculpture Garden from September 15 to November 13. They will then move to the San Francisco Museum of Modern Art, December 15 to February 5. Curator Valerie Fletcher calls them "works of extraordinary power, value and fragility." The show is supported by the joint sponsorship of Crédit Suisse and the Xerox Foundation, with supplemental assistance provided by Balair and the Pro Helvetia Foundation.

Giacometti was one of the most illustrious and innovative artists of postwar Europe, a man of great intelli-

Alberto's favorite subject was his younger brother Diego, who is shown in detail of a cavernous bust, 1957.

In *Reclining Woman Who Dreams*, rhythmic motion within abstract forms suggests the flux of dreams.



The Invisible Object (*Hands Holding the Void*), 1934, presents life-size bronze figure with enigmatic effect.

gence and enormous intensity, a sage of anxiety who devoted himself to propagating a brood that made the art world rub its eyes in wonder. One art historian spoke of "nervous structures dipped in matter, which coagulates and adheres in awkward clots," and another compared the figures to "poorly chilled lava." Jean Cocteau, when he saw the *Gazing Head* of an earlier period, wrote of "sculptures by Giacometti so solid and yet so light that one thinks of snow bearing the imprint of a bird."

Giacometti's obsession with the essence of Man and the nature of vision led to a shearing away of distinctive detail. "I'd like to make a head that would be the head of everyone," he said, "but which, with only slight modification, could become any particular person."

He seemed to stoop under the burden of art, a short, unkempt, Montparnasse bohemian given to whipping out his yellow scarf from a pocket of his wrinkled suit, and tying the scarf absentmindedly about his neck, looking for all the world like Chico Marx down on his luck. Jean Genet, the author who posed for him and became his friend, said "through sympathy perhaps he took on the color of dust." Giacometti was addicted to smoking, to ungodly hours talking time away in cafés when he was not working through the night. He looked older than his years, his brooding face deeply lined, his complexion sallow. A man who valued sincerity, he struggled with feelings of inadequacy and guilt.

"An altogether humble artist and man"

Home was a slum of a Paris studio, where he was indifferent to comfort, possessed by feelings of insecurity, and where he worked in a creative, often anarchic frenzy, exclaiming about the impossibility of capturing what he sought and what he saw, or even of seeing clearly. The American artist Raphael Soyer called him a "rare, searching, noncompetitive and altogether humble artist and man." For Giacometti, great art demanded obsession, and his ideal would have been to work on only a few statues during a lifetime, scraping closer and closer to essence. But he came so close to changing bust to dust that the ideal stood aloof, tantalizingly elusive. He saw himself as a Sisyphus struggling to push a burden uphill, pursuing an eternal martyrdom. "Despite all my efforts," he said, "I retain conventional elements which I want to get rid of." He was at once happy and discontented with failure, believing that each defeat drew him nearer to the ideal of reality that he had set himself. "I see my sculptures as landmarks on a line reaching forward," he suggested. "I begin, but don't know what the end will be."

What Wittgenstein was to philosophy and Beckett to the theater, Giacometti was to art. They despaired of

the capacity of language to express meaning; he bewailed the failure of art to convey reality. "I'm not sure of my vision unless I see it on canvas or in sculpture," he said, "but as I put it on canvas or in sculpture I modify my vision." He pursued the impossible, hoping to profit from the search. Soyer suggested that "in its frustration and obsession, even in its limitations, there is something redeeming."

It is details of perception that one receives and then by inference composes into figures, but Giacometti wanted to present not figures composed from perceptions but perceptions raw—art as imitation not misguided by emotion or intellect. "I'm almost rid of the screen between my vision and things," he once said to me, wavering as usual between hope and despair. "I'm not sure I see you, for example. I'd have to put you on canvas. Then I might begin to see you a little."

Icons to view at a distance

He drew his subjects principally from the people and objects he lived with—his mother, his brothers, his wife, apples on a table, objects in his studio, the chair in which he sat, his bed. His figures appeared lonely, alienated. These were not objects to enjoy, but compelling, often importunate figures, icons to be viewed at a distance. And because Giacometti was dissatisfied with what he created, he destroyed, in surges of "panic depression."

The struggle with life and its disappointments began in Borgonovo, a gray, rocky, Swiss village in a valley near the Italian border, where the vernacular is Italian and where the craggy landscape appears to be inspired by Giacometti. Several years later, the Giacometti family moved down the road to neighboring Stampa.

His father, Giovanni Giacometti, was a Postimpressionist painter. As a child, Alberto copied reproductions of Old Master paintings. His first sculpture was a bust of his brother Diego, who was a year younger. Brother Bruno was apprehensive about posing for Alberto, lest he be caught, like a fly in a web, and kept from play. But in the Giacometti household it was considered a duty to pose—for father or son. Alberto, so good-natured as a rule, in his later years became a tyrant to his models, obliging them to pose without the slightest movement.

He studied painting and drawing at the Ecole des Beaux-Arts, and sculpture at the Ecole des Arts-et-Métiers in Geneva. He also drew, and painted portraits and landscapes in watercolor and in oil.

When his father was appointed to Switzerland's delegation at the Venice Biennale, Alberto went with him and thrilled to the art of Tintoretto, to Giotto's frescoes in Padua, and in Assisi to the works of Cimabue. On his own, Alberto went to Florence and then to

Seated Woman, 1949, shows Giacometti's young bride, Annette, on her first visit with his mother in Stampa.

Rome, where he drew and sculpted. He copied artworks and painted idiosyncratic, pointillistic landscapes. Recalling this period years later, he would write that he was convinced the sky was blue only by convention, and really red. He tried a couple of sculpted busts but was unhappy with them—the head of the model turned into a cloud and when he could not firm cloud into clay, he destroyed the busts.

Willful and adventurous, he decided to give the musty art theories he'd been sifting a chance at the invigorating air of the world's art capital. In 1922 he arrived in Paris and enrolled at the Académie de la Grande-Chaumière. For three years or more he studied under Antoine Bourdelle, sculpting in the morning, drawing in the afternoon.

Giacometti moved from one unpretentious studio apartment to another even more ramshackle and shabby. "After two years of Paris," he said decades later, "leaving was out of the question." But he returned often to Stampa to see his mother, whose favor-

Memory of medicine cart he saw during 1938 hospital stay was transformed into monumental *Chariot*, 1950.

Walking Man I, 1950, was commissioned by Chase Manhattan Bank. Tall figure was to be one of group.

ite he was, and to renew contact with friends of his youth. After witnessing the death of a traveling companion in 1921 he became terrified of the dark, and ever afterward slept with a light burning beside his bed. On retiring at night he had always been compulsive about the exact placement of his shoes and socks, and unconcerned about where he flung the rest of his clothes. Obsessive about the arrangement of the objects on the table in his room, he found himself unable to work because he could not resolve the dilemma of that arrangement: "The search for this order, either by thought or by trial and error, was a true torment for me. So long as I had not found it, I was as though paralyzed, unable even to leave my room to keep an appointment."

In the late '20s Giacometti discovered and joined the Surrealists and entered a tremendously creative period. Many of his Surrealist works exhibited aspects of cruelty, violence, eroticism and death—a woman dreaming, another with her throat cut, a flower threatened with destruction, a man's head on a rod. His Surrealist sculptures brought him fame within a few years, and he made many friends among the artists and writers of the city. But eventually he broke with the Surrealists because, "the better things go the less closely tied to others you are."

His work showed many influences: Cycladic sculpture, African and Egyptian art, Cubism, abstraction (especially sculptors Henri Laurens and Jacques Lipchitz), but he struggled to go beyond. To earn a living he began working for an interior decorator, designing objects that his brother Diego helped construct—chandeliers, floor lamps, vases, chairs, tables, andirons, doorknobs. He designed jewelry for couturier Elsa Schiaparelli. "At first it disturbed me to do these things," Giacometti said. "First you think it's easy, but then you see that even they are difficult." Diego became his assistant also in working on sculpture—making armatures and plaster casts, helping to carve stone, adding patina to the bronzes—serving Giacometti as what the sculptor once called his third and fourth hands.

In sculpture he searched desperately, not sure what

Israel Shenker's latest article in SMITHSONIAN *was about Legoland in Denmark, in June. He interviewed Giacometti when a* Time *reporter in Paris in 1951.*

Dog, 1951, was an alter-image of the artist that had come to him one day while he was walking in the rain.

Stylized portrayal of *Four Figures on a Pedestal*, 1950, was inspired by prostitutes in a local brothel.

he wanted, but convinced he didn't have it. "I knew that no matter what I did, no matter what I wanted, I would be obliged someday to sit down on a stool in front of a model and try to copy what I saw." In 1935 he took a model so that he could study the construction of a whole figure; he planned to devote two weeks to the problem. After a week, seeing that he was getting nowhere, he decided to try to do merely the head, but the more he labored the less clearly he advanced. Day after day he worked with that model, from 1935 to 1940. Twice a year he began two heads, always the same ones, and never managed to finish them: "A head (I quickly left aside figures—that was too much) became for me an object completely unknown and without dimensions."

Taking Diego as his model, just as he had for his first sculpture, Giacometti dug away resolutely, never satisfied, again and again reworking each sculpture he failed to destroy. "He's posed for me ten thousand times," he said. "When he poses I no longer recognize him. I want to make him pose so that I can see what I see."

The more Giacometti labored from life, the thicker grew the screen between reality and image; whenever he sought to approach it, reality took flight: "One starts by seeing the person who poses, but little by little all the possible sculptures of him intervene. . . . One is no longer sure of his appearance or size or anything at all. There were too many sculptures between my model and me. And when there were no more sculptures there was such a total stranger that I no longer knew whom I saw or what I was looking at." Falling short each time, he was all the more determined to succeed, to pursue the endless adventure that stretched before him, convinced that it was impossible to copy nature, but unthinkable to abandon the attempt. When he failed to make even a head that was up to the standards he envisioned, he decided to try yet again to do a whole figure. He began to work from memory as well as from a model.

In 1938, after being knocked down by a car, Giacometti spent months in a Paris hospital and was left with a slight limp. He spent most of the war years in neutral Switzerland, working at tiny figures. For an exhibition in Zurich, where his work was to stand in a courtyard, Giacometti arrived in person bearing the statue: a figure two inches high.

Still Life in the Studio was one of a series done by the artist during the 1950s. Though the scene is one of clutter and mess, the work itself is carefully balanced. "Here sculpture and painting mix intimately," a visitor once wrote of Giacometti's studio.

Giacometti was terrified to find his sculptures getting smaller and smaller until they were only about an inch high, minuscule pin-forms, with pin-heads, ready to collapse into dust with one flick of his knife. They seemed to resemble life only when small, when the entire figure could be assimilated in a glance, but the tiny dimensions appeared to him revolting. When he went back to Paris after the war, it was said that he took with him his entire Swiss production in six matchboxes. Then just as the sculpted figures were about to disappear altogether, they began to grow and appear as likenesses only when tall and emaciated, as though drawn by a perverse antigravity—furrowed, rough-surfaced figures, standing on huge, elongated feet. As they grew ever more scrawny, pared beyond the bone, it was as though existence imposed the paring knife. "Images of the numinous," critic Herbert Read called them. In 1947, art dealer Pierre Matisse persuaded Giacometti to send his work for exhibition in New York. "I found it precipitate even then to have an exposition," Giacometti said, "but when your works are in bronze, and in photographs, you see where you are." His friend the philosopher Jean-Paul Sartre wrote an introduction to the catalog, entitled: "The Search for the Absolute."

A few years later, Giacometti collected some of the figures into group sculptures—attenuated men walking or standing immobile, a collectivity of gaunt figures, gouged and haggard. When he viewed distant objects he saw them as small—not an illusion created by distance, but as though the figures actually were small; objects close to him appeared impossibly gigantic. He did figures that resembled trees of his childhood, sculpted himself solitary, hurrying through the rain, and also as a miserable dog in the street.

When Giacometti exhibited in Paris after World War II he was still dissatisfied. He found skepticism natural, shifted his second thoughts into third thoughts, then cloaked his revisions in doubt. Nothing was ever finished; perfection was illusory. In the 1951

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catalog, for his exhibit at Galerie Maeght, his friend Michel Leiris put Giacometti's course succinctly: "To make, to perfect, to unmake, then to remake, to reperfect, to reunmake. . . ."

He found it difficult to see any sense in copying a model during set hours and often continued to work on a sculpture for weeks without the model being present. Seeking different effects and a more lifelike resemblance, he took to painting his sculpture in flesh tones with dark accents, and to having his bronzes finished in dark brown and polished gold. He complained of being too close to the model, for "if one began with a detail, a heel or the nose, there was no hope of ever arriving at a whole." And if one began by analyzing a detail, "the end of the nose, for example, one was lost. One could have spent one's life without achieving a result. The form dissolves, it's no longer anything but granules moving over a deep black void, the distance between one side of the nose and the other is like the Sahara, limitless, nothing to fix on, everything escapes."

Assailed by old problems, continually searching for new beginnings, obsessed by a sentiment of failure, Giacometti went back to the brushes he had largely abandoned. "I always wanted to begin again," he said. "I thought I saw better in painting than sculpture." The canvases were closely related to his sculpting style, with similar elongated stick figures, but the paintings lacked something of the craggy obscurity that suffered through three dimensions. Thickets of thin, nervous brushwork concentrated about the eyes; what constituted the difference between the living person and the dead images was each person's look—the eyes had it. Noted Sartre: "Lyrical when he sculpts, Giacometti becomes objective when he paints."

His paintings confined themselves to a limited gamut of colors—black, white, gray, ocher. Colleagues urged him to brighten his palette. "I certainly tried," he said, noting: "In the course of the work, I had to eliminate one color after the other . . . . in the end, there remained only gray! gray! gray!" He was troubled by the paradox that in painting it seemed impossible to create a work by adding one detail to another. "You have to make a complete totality all at once."

In 1963, viewing his works in a Geneva gallery, Giacometti said: "All this is only sketches. I do as much as possible with the same model, but I'll never finish. Every day I find something new. The closer you approach, the more there is to see; the more you know, the more mysteries there are."

His skeletal figures appeared to symbolize the alienation, anonymity, anxieties and terrors of the age, but when it was suggested that his ravaged figures were far from reality he was quick to agree. "You're so right," he said. "It would be better if I abandoned it all. I've been working so many years, and I haven't succeeded at making anything. I see that it doesn't work; nonetheless, I stubbornly continue." At work he cried out, "It's no good. I have to give it up! It's useless. I'll never manage." But he persisted, believing that in another quarter of an hour, or the next day, or the following week, he would succeed. Other artists approached the end of each work; he fled it. Others found fulfillment; he collided with disabling fear.

In the mid-1930s, when a New York gallery offered Giacometti sculptures for $150 to $250, there were no takers. Twenty years later, huge success attended his work and the exhibitions that were held all over the map: New York, Chicago, London, Bern, San Francisco, Venice, Düsseldorf. Though he grew wealthy from his art, he refused to indulge in luxuries like a home with hot water and modern plumbing. In 1965, a Swiss group established the Giacometti Foundation in Zurich by acquiring from G. David Thompson a great Giacometti collection of 59 sculptures, 8 paintings and numerous drawings, since grown to more than 150 works. The foundation divides its holdings among art institutions in Zurich, Basel and Winterthur. Today Giacometti statues sell for millions.

He died in Switzerland in 1966 and was buried in his native soil, beside his mother and father. Diego designed the tombstone, which features a sculpture by his brother. A plaque on the facade of a house in Stampa commemorates the birth there of artist Giovanni Giacometti, but no marker indicates the birthplace of Alberto, the illustrious son who spent a lifetime jousting with the void.

Giacometti's lifelong preoccupation with the gaze of subjects culminated in intense vision of late work.

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COOKING & BAKING

By Daniel Cohen

On the competitive cook-off circuit, they go for the gold

Amateur chefs bake, barbecue and boil in more than 3,000 contests nationwide as they vie for prestige and prizes with home-hyped victuals

Sally Vog drizzles a grid of melted dark chocolate on a pan of white brownies. "I'm just a newcomer. I've entered contests for only four years," she says, deftly maneuvering in her tiny kitchenette, one of 100 set up in a San Diego hotel ballroom. Newcomer or not, the intent homemaker from Springfield, Oregon, has swiftly made her mark as a competition cook. In a single year, she won the National Chicken cook-off, came in second in the National Beef, and has claimed prizes for chocolate chip cookies and a salad recipe. Now she and 99 others have reached the Pillsbury Bake-Off (in spite of the name, it is not limited to baked items) with its $40,000 grand prize. Cook-offers call it "the elite, the royal, the queen of contests."

The Pillsbury extravaganza's outsize scale—100 cooks packed into one room, $126,000 in prize money—may enable it to grab the limelight when it takes place every other February, but the event doesn't stand alone in the world of competitive cooking. There is a year-round circuit of amateur recipe contests and cook-offs throughout the country; sponsored by food manufacturers, trade associations and local festivals, more than 3,000 of them honor everything from oysters to eggs to farm-raised catfish.

The forerunners of these cook-offs are solid Americana: the blue-ribbon contests for food preserving and pie making that have been with us since the state fairs of the mid-19th century (when sweet pies became a national obsession) and, later, manufacturers' promotion of "creativity" in the kitchen using packaged foods. These strains of culinary culture merged during the 1930s when frozen desserts burgeoned right along with the sales of refrigerators. Then, in 1949, Pillsbury set up 100 electric stoves in the Waldorf Astoria ballroom, powered them with current from the Manhattan subway that ran beneath the hotel, somehow persuaded Eleanor Roosevelt to help announce the $25,000 prize-winner—and the corporate cook-off assumed its mature form. Throughout the '50s, finalists' recipes took hours to prepare and shunned convenience foods (as well as "intoxicating beverages," at the company's orders). In the '60s, recipes got much simpler. Finalists were blithely adding mashed-potato flakes, canned vegetables, breakfast cereals, candy bars and ready-to-spread frosting to the ingredients. Lately, an ethnic revival has flavored entries as contestants draw inspiration from ancestral foods.

And so I find my food-loving self confronted by a range of cooking contests that includes enough of my all-time favorite dishes (along with several I avoid at all costs) to make these rivalries an enticing, though not slimming, spectator sport. There are obvious risks: not fitting into my trousers afterward or maybe being served something with lacquer-look cheese topping along the way. But the temptation to taste recipes judged to be worth thousands of dollars proves irresistible. Earlier this year I set out for three high-stakes events—the Pillsbury Bake-Off, the World Championship Barbecue Cooking Contest and the Chef Boyardee/Pam Pizza Cook-off.

Toward the unboring world of Pronto Egg-Ritos

Even before my odyssey begins, I learn that corporate cook-offs do not replicate harvest judgings at county fairs. Classic farm-kitchen food is, well, too boring for big-prize material at a conglomerate's shindig. As veteran contender Annette Erbeck of Mason, Ohio, explains, "An apple pie isn't original, but in a cheddar cheese crust—that would be a different slant." She is preparing to compete in her third Pillsbury tourney with Easy Vegetable Bulgur Salad. This dish, she admits, is probably not exciting enough to win a major prize—not like her Pineapple Cheese Baklava that won $25,000 at the 1979 Pineapple Cooking Classic in Hawaii. My dreams of crispy fried chicken, fluffy mashed potatoes and flaky-crusted cherry pie are fading. I'm obviously headed for Pronto Egg-Ritos, Oyster Fettucine Caper and Lime Tart Elegante.

The steady escalation of prizes fuels the search for

Regi Donaldson tapped her Lithuanian background for makings of Lickety-Split Cupcakes (30 minutes).

Photographs by Vince Streano

As she dropped nuts into a Bundt pan, Debbie Russell "hoped the cake would rise—but not the baby."

Separated by swath of spaghetti cable, Pillsbury finalists confront stoves—and the moment of truth.

such creations. Chef Boyardee/Pam awards its winner a $15,000 Caribbean cruise for four. Creating the best new potato chip dip or topping is worth a station wagon, a diamond pendant and a trip to Hawaii. A recipe using nuts may yield an agreeable dessert—or a $100,000 savings bond. It's a dizzying thought.

That sentiment may help explain the giddiness as Pillsbury finalists gather in San Diego. Of course, there's the anticipation of the two-day round of banquets and tours before a single oven is lit. But another source of reunion-style exhilaration soon emerges: many of the competitors are already acquainted. The legion of entrants includes two sets of mothers and daughters, two teenagers whose grandmothers competed against each other 20 years ago, two husbands of previous competitors, and at least a score of veteran Bake-Offers. By my count, more than a third of the group—selected from tens of thousands of entrants by an elaborate, blind procedure—have either been finalists before or have an immediate family member who has (though others, it's true, made it here with "one recipe, first try"). As at Wimbledon, many top contenders make it to the play-offs.

The action begins at 8 A.M. as a brass band strikes up "When The Saints Come Marching In" and George Pillsbury (founding family, board of directors) leads a brisk parade of contestants, all in identical aprons, to the ranges. The clatter of spoons and whir of mixers echo in the ballroom. By 8:30 the smell of melting margarine and sautéed onions wisps into the air, the temperature in the appliance-packed hall is climbing and one baker has already discarded a microwaved cake because it stuck to the pan. She promptly begins the second of three tries allowed by the judges, who are sequestered in a nearby meeting room.

At Range 31, I find Elaine Schultz methodically rolling out circles of refrigerated dough. She works with the calm of a seasoned contender, which she is,

At the end of his culinary quest and in spite of his worst fears, Daniel Cohen, a regular contributor, did not have to head for the "52 Portly" suit rack.

No sinks? No problem. Dirty dishes are whisked away by floor assistants, washed by marketing executives.

"I'm of Portuguese descent—we love soups," says Olga Jason; a spinach variation got her to the finals.

having recently won four major prizes. "Which ones? OK, I won $4,000 from Quaker Oats. Uncle Ben's Rice, $1,000. *Family Circle* Canned Food Contest, $1,500. And a first place in Campbell's Soup, $1,000."

Schultz, a painter and teacher who lives in Miami, almost literally stumbled into her first recipe contest in 1982, seeking diversion while laid up with an injured foot. It was a pizza competition. "I put together a takeoff on a Reuben and had the nerve to call it 'Reuben Eats A Pizza.' " It was a nonwinning effort. Then she entered another contest—without even tasting her creation—and won a set of cookbooks. "People say how dare I, and I say who is to stop me?"

Her recipes usually germinate with a sort of culinary free association. "I'm an artist. I enjoy putting together colors. It's a mental thing, a creative thing. I always carry a notebook. I can be driving down the street and get a combination, like basil and burgundy, which I used in a pizza and in a soup with processed cheese, which is really the pits. Sometimes I substitute ingredients—like for Campbell's I made a variation of lobster thermidor with chicken and cream of shrimp soup."

Schultz says she does her best cooking in the morning. She researches old cookbooks, but has learned to take her family's verdicts on the results with a grain of salt: "They once told me a recipe sounded like a good mulch—it was tomatoes, sauerkraut, white wine and pinto beans." When it won a prize, her abashed husband and sons had to beg for a taste.

Like the classical music she listens to when in the kitchen, Schultz says of the contest circuit, "It's always in my head." On her calendar are the dates of entry deadlines and winner announcements. Pressure builds as deadlines near: "It was toughest when there were six major contests closing in three weeks—Planters, Aunt Jemima, Ronzoni . . . you got confused." But she imposes rules. "I don't change a recipe too many times. If I get into trouble, I say to heck with it. Sometimes they're a total flop; that doesn't bother me." Rule 2: "I do not bake cakes or cookies. To bake a cookie almost shatters me—the bottom is always burned."

Like many successful cook-offers, Schultz shrewdly

matches recipes to a sponsor's corporate posture. "Pillsbury looks right across mainstream America. You couldn't go in with really gourmet," she says. And she decodes contest rules with lawyerly precision. "Each year the Chef Boyardee contest has changed the judging percentages more in favor of creativity. Now they want something really original. What do you do? Wrap dough around lightbulbs?" As for prizes, Schultz matter-of-factly counts on some winnings each year. She budgets part of the cash for her retirement, and calls the trips "sheer fun and vacation." But annoyance creeps in when she speaks of typical consolation awards: "To give electric mixers to a hundred wonderful cooks is beyond belief!"

As I move along the aromatic aisles I am drawn to Range 59, where Joan Wittan, a health educator from Rockville, Maryland, is decorating an Almond Raspberry Torte—and keeping a weather eye on her husband, epidemiologist Mark Schiffman, who is assembling his Cranberry-Filled Layer Cake nearby. As the first husband and wife to compete against each other at the Bake-Off, they are barraged with questions, most often about who does the dishes at home (both). They pursue competition with scientific thoroughness as members of a team of seven friends who, before submitting their recipes, host a mini-bake-off, serving 40 dishes to guests for rating. The system works: since 1974, five teammates have reached the Pillsbury finals. "There's a special quality to competition among women," Wittan comments. Like me, she's observed the reluctance of contestants—93 of whom are women—to indulge in open competitiveness: "They're more overtly supportive, though there is tension. It's not like football. You can't psych yourself up to cook better."

Whole Hog barbecue judge Ardie Davis pigs out on an entry; he'll cleanse his palate with beer and saltines.

By 9 A.M. the Bake-Off floor resembles a carnival midway at high noon. Floor assistants scurry to stoves with fresh ingredients and whisk away trays of dirty dishes. TV crews and food editors crowd contestants for interviews: "How will you make this special for the judges?" They might better ask, "How do you avoid calamity in the mayhem?" Before it's over, one finalist flips her quiche onto the carpet, another ignites a pot holder, a third sits on her finished cake.

"The secret ingredient is nutmeg"

As noon approaches, completed entries begin to fill a triple-tiered display table at the front of the ballroom. I'm hungry, but until someone abandons an attempt or makes an extra—one round goes to the judges, another is for show—there's not much available to eat. Leery of the stomach-turning sweetness that seems to dominate the desserts, I wait for the more savory dishes. There's little rapture but plenty of agreeable munching. An Italian torta seethes with molten cheese, yet crunches with sesame seeds. A cold, spring-green spinach soup offers a delicate tang. "The secret ingredient is nutmeg," confides 73-year-old Olga Jason, who has been trying to make it to the finals since 1949.

Still, I don't envy the eight judges, who have to rank an armada of platters. They confirm it's no picnic. After dismissing many entries with a curt "It's terrible!" they call for carbonated beverages and settle down to serious decision making. As one of them puts it, "When you're pitting pizza against cookies, you ask 'Is it better as a pizza than the cookie is as a cookie?'" Arguments continue for three hours, perhaps prolonged by the knowledge that a winning recipe quickly goes on the menu in thousands of homes (a runner-up once provoked a stampede that cleared the nation's

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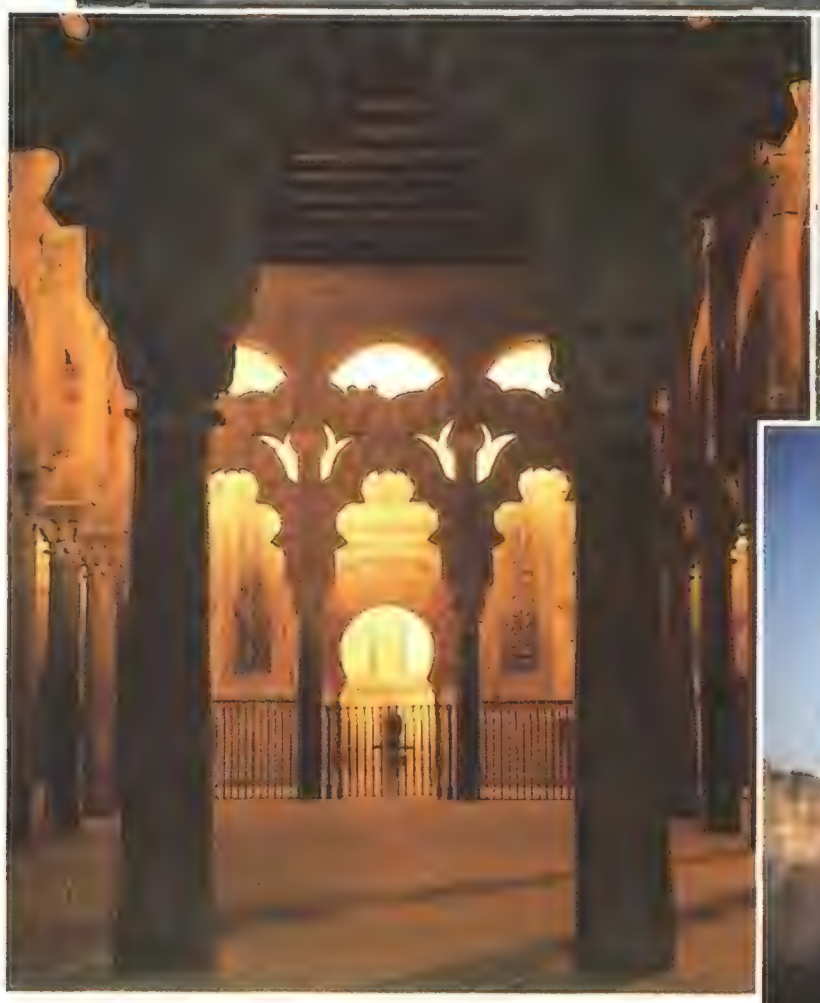

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Yes, the pink bottle is the Pepto Porkers' barbecue grill—with a 3-by-6-foot cooking area that can hold 175 pounds of meat. Standing before it, Jim Blair and Maggie Conway: "Our team is the classiest of all."

shelves of Bundt pans). "It's staggering, the effect on the rest of the country," says judge Gloria Glyer, food editor of the *Sacramento Union*. "People will make the winning recipe for generations."

Home from San Diego, I decide it's time to become a contestant myself. I quickly learn to appreciate their doggedness; the work is hard and includes niggling details as well as the risk of personal rejection. The actual cooking, I find while devising an entry for the Chef Boyardee trials, plays only a small part. I'm cocksure at first—settling on a concept seems easy. I opt for Mexican pizza with black beans, fresh sausage and green chilies, blissfully unaware that Mexican pizzas are a cook-off cliché. Locating the prescribed pizza mix is harder; it's not in the supermarkets anywhere near my home in New Jersey—another predictable crisis of cook-offery, it turns out. I spend hours searching, in ever-widening circles. Finally, relatives south of the Mason-Dixon line have to mail it to me.

At the stove, I'm shocked to learn that recipe-contest cooking doesn't blend with my cheerfully imprecise, dabs-and-pinches style. Cook-offs require exact measurements and cumbersome minute-by-minute note taking. How do you decide between ¼ and ½ tsp.? My confidence erodes further when neighbors judge the result. They silently nibble the soggy wedges as sheets of beans and grated cheese slide plateward. Glumly, I redesign the recipe for a pie plate, and cement the topping with lots of melted jack cheese. I'm hoping to rescue it with a catchy name, Deep-Dish Mexi-Pizza.

And there's more. My recipe covers a big yellow pad, but as an entry it must fit on a 3-by-5 card. This requires a purely literary skill for concise recipe writing; my training is nil. Here is where champs leave the pack behind—making sure that entries agree with the contest's fine print. Expert advice from the "Blue Ribbon Cooks' Newsletter": "It is generally accepted that when a piece of paper is required, a card can be used, but when a card is requested, a piece of paper cannot be used." By the time my entry goes into the mail, I'm no longer sure that cook-offs mean easy money.

For a change of menu (and venue) I head for the annual World Championship Barbecue Cooking Contest, at Memphis. Here I find a completely different crowd. Men lead nearly all of the 175 teams, and cooking suddenly *does* resemble football, a sport where endurance and toughness count—fires must be tended for as long as 24 hours straight while the entries (all pork, in categories of Ribs, Shoulder and Whole Hog) are roasted. But one strong similarity with the Pillsbury agenda quickly emerges: for finalists, even *getting* to this contest, regarded as the most important of its type, represents a victory. "This is the ultimate goal—just being here," says Jim Turner, a veteran of

THE RESPONSE HAS BEEN TERRIFIC:

In the latest J. D. Power & Associates Initial Quality Survey, new car owners put three General Motors makes at the top of the list of 1988's best-built American cars.

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- ✔ **Cadillac**
- ✔ **Buick**
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MEASURING THE RESULTS

Now our efforts are beginning to be recognized. Not only by the owners in the Power survey, but by others who are just as qualified to judge the results of our commitment to quality.

- ✔ **Pontiac Grand Prix, Oldsmobile Cutlass Supreme, and Chevrolet Beretta swept the competition for MOTOR TREND Magazine's 1988 *Car of the Year* honors.**
- ✔ **Chevrolet's Full-Size Pickup was named by readers of FARM INDUSTRY NEWS as one of the top farm products of the year. It was the only vehicle of any kind to make the list.**
- ✔ **The Chevrolet K1500 Full-Size Pickup won FOUR WHEELER Magazine's award as "the 4x4 of the year."**
- ✔ **The Oldsmobile Aerotech, powered by a version of GM's revolutionary Quad 4 engine, set a new closed-course speed record of 257.123 miles per hour.**

While all these achievements were hard earned, and the recognition well deserved, the most important reaction to our efforts has come directly from our most important constituency--our customers. Their response has been one of overwhelming approval: as of June 10, GM sales for this calendar year had increased by 9.4%. That's the strongest indicator that our vision of our customers' needs has been sharp and clear.

GM

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Holy Smokers start to set up; Chuck Osborne, Rick Cooper, Rock Janda then "Q-ed" to the championship.

Carl Barsotti pulls rack of ribs from grill that once smoked the local highways; windshield, seats are gone.

boating, dirt-bike, fishing and hunting competitions. His team, the Super Swine Sizzlers, has landscaped the front of its booth with a hedge of imposing barbecue trophies emblazoned with frolicking hogs.

The men make sure no daintiness spoils the contest, held each May in a narrow park overlooking the Mississippi. This is done in part by creating a nearly uninhabitable environment. Suffused with choking, hickory-scented smoke, the bare promontory becomes an inferno of stoked fireboxes superheated by the blazing Delta sun. There's freely flowing beer and lots of precontest barbecue of brisket, bologna, shrimp, ham and ribs. Preparations turn into all-night revelry, with a couple hundred close friends packing each booth.

Elvis' guitar and other custom-built grills

Roaming the site, I can't help noticing that when men start cooking, the hardware gets complicated. Custom-built cookers—massive contraptions of cast iron and stainless steel—may cost $15,000 or more; they incorporate the team's barbecue philosophy. "We burn straight hickory under a baffle," Jim Garts, coleader of the Hogaholics, points out as he gingerly opens a scorching firebox that vents smoke across a water tray beneath a 4-by-8-foot grill. It's built on a trailer the size of a mobile home. Other cookers have been fashioned from a marine diesel engine; from a '76 Datsun, with grilling racks instead of front seats, a chimney above the dash and coals under the hood (below); and as a 15-foot version of Elvis Presley's guitar (by the Graceland Love Me Tenderloins). It's awesome ironmongery.

But I came for barbecue, so I'm relieved to hear Chuck Slaten say, "I think I know what a barbecued rib should taste like." With craggy face, steely hair and piercing gaze, he's a master of barbecue rhetoric, a condiment as indispensable as sauce:

"It starts with sweetness, but that rolls off. Then you think it's too hot, but it's not. You enjoy every bite and you get that little tartness and little touch of hot and sweetness at the same time—and still taste spices in the ribs." He serves a portion, watching me intently while I chew. He's, ummm, absolutely right. "I do a couple of things no one else does," Slaten goes on, working two smallish grills. "I'm called a mustard monster—I put all the spices on the ribs and then coat them with a mustard concoction. Notice I cook *directly* over the fire, the barbecue tradition, straight up." A burly, sweat-drenched 48-year-old, he displays a carefully stitched banner listing his two-dozen barbecue titles. "I've pretty well stayed with my style, and one of the main carriers in my sauce is black coffee," he discloses.

But I realize I've got no hope of coming home from this contest with a great recipe, Chuck Slaten's or anyone else's. "Oh yes, it's secret," he says of his complete

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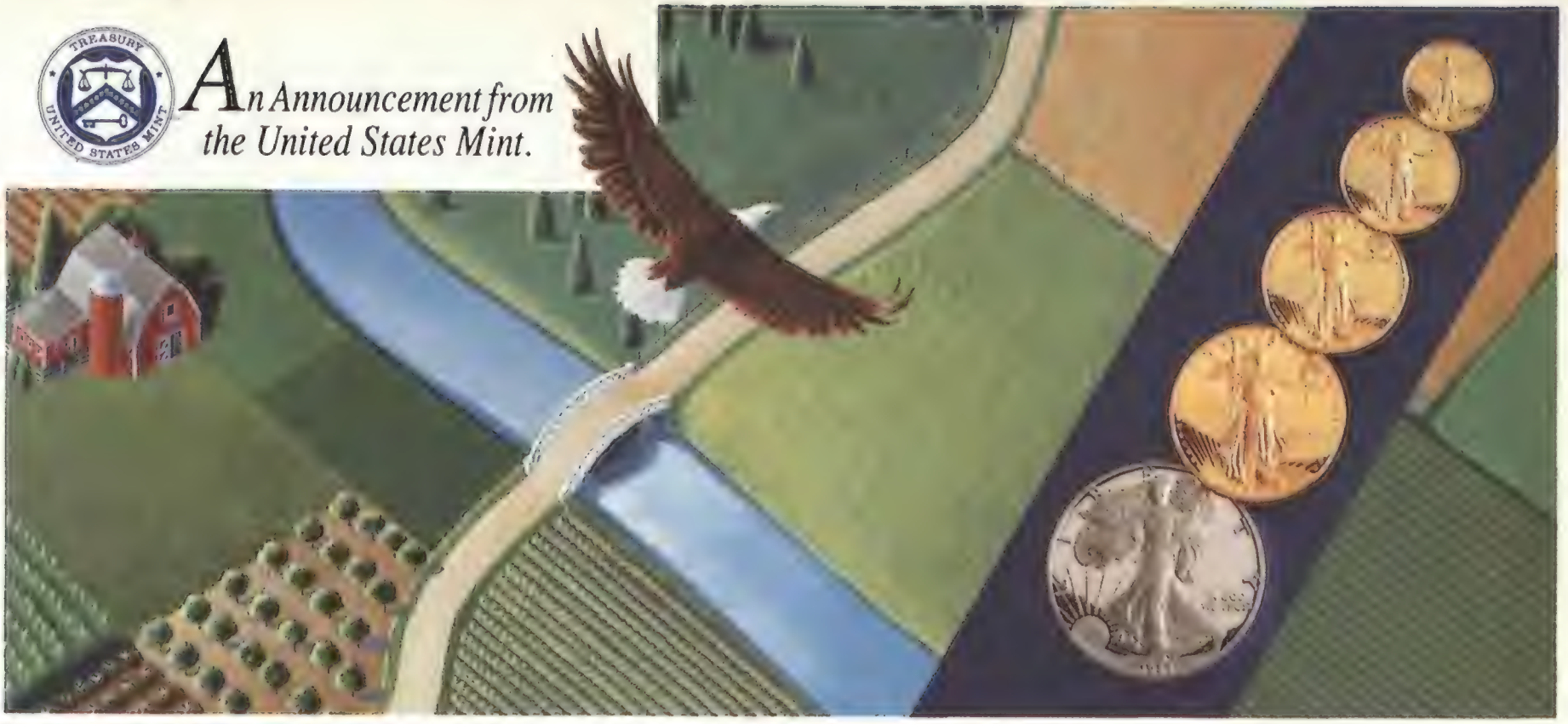

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formula. "I guarantee you the recipe is in Mommy and Daddy's lockbox in Arkansas, and it's in my will who gets it." Such secrets rarely guard a financial empire or, unlike the brand-name cook-off circuit, even the hope of one. "The rewards? Bragging rights, prestige as world champion and pride—'Hey, I done it!'" Slaten explains. "On the money you'd certainly go broke in a hurry." I do discover, however, a dream shared by Slaten and other serious "Q-ers": to open a barbecue place, as two former champs have already done. Maybe then, they think, they could cook every day, a state of grace that most family women in other cook-offs have long since attained. Never once did a Pillsbury finalist mention wanting to open a restaurant.

By morning I know why the sponsors tried to dragoon me into being a judge—they need 300 to fan out for on-site tastings. I'm glad I refused (on the grounds of being a Yankee with perhaps dubious credentials) because those who do serve have wildly varying qualifications, and finalists start muttering about being judged by wimps. At nearly every booth, as the judge examines the grill, the cooks size up the judge—the first question is always "You from Memphis?" My overgreased system is already longing for crisp salads.

I follow Ardie Davis, a judge who's drawn duty on the Whole Hog circuit. He's from Kansas City, the Athens of barbecue if Memphis is its Rome. At the booths, starched tablecloths, cut flowers and freshly shaved competitors await him; it's all gentility after last night's rowdiness. Each presentation is distinctive. At Collingwood Boarmasters, Toronto chef Eric Madden cuts slivers from the rump of a vast hog. Subsequently, Davis is served chopped pork with sauce, and shredded ham with slaw and beans. At the last of five stops he nods approvingly and says, "The sauce kind of pats you on the back while you eat."

An hour later, tables of "inside" judges, shaded by a tent, are blind-tasting pork shoulder—just taste, no spiel. The variation among entries is startling, ranging from dispiriting, grayish, oily chunks to tasty brown shreds and delicious-looking pink-white slices with a dark crust. Nearby, Price Waterhouse accountants at computers tot up the ratings. Then more judges head out to visit the top finalists. By that time I'm sampling Darrell Hicks' pork shoulder; yesterday, his Cajun ribs were a marvel of sweet crispiness enclosing a spicy core. As far as I'm concerned, there's no contest.

In Chicago in June, I arrive at the Chef Boyardee/Pam Pizza Cook-off fully expecting to be amazed because the contest has ratcheted up its reliance on originality. The 20 second-prize recipes indeed include Polynesian, Greek, Bavarian, Swedish, Oriental, Niçoise, several Mexican (alas, not mine) and, yes, Elaine Schultz's Basil-Burgundy Garden Patch pizzas. But the recipes of the five adult finalists suggest home cooking rather than souped-up contest fare. They assemble pizzas at a semicircle of stoves in a room decorated with a papier-mâché gondola and trellises of greenery and plastic grapes. Compared with the earlier spectaculars, this event is almost cozy, but it's here that the judges—food editors and executives, and advice columnist Ann Landers—have it especially rough. They face the contestants from a banquet table in view of the stoves. Pizzas must be served on schedule, every seven minutes. Judges chew in silence, glance meaningfully at one another and scratch notes on their scoring sheets. There's little privacy for blunt commentary. As samples keep arriving, Landers' eyes begin to bulge. There are plenty of leftovers and I'm tasting from the sidelines, appreciating the merits of a Chuck Wagon Pepper Steak Pizza topped with sautéed strips of beef.

Then five teenage finalists, in a separate competition, present "picture" pizzas, with shaped crusts and mosaics of black olives, sliced sausage, tomatoes and broccoli. Most are portraits—an Indian head, a Mickey Mouse, a clown. But Steve Lott, a 14-year-old from Stanton, Michigan, creates Hawaiian Pizza, which is shaped like a whole pineapple, topped with the fruit and ham, and ornamented with slivers of green pepper "leaves" (opposite). "I entered because my home ec teacher told us to," he says a trifle sheepishly. "But nobody told me I'd be the only guy in this." The judges appreciate his work. When he's announced as the winner of a $10,000 scholarship, his jaw drops. "I didn't used to cook," he murmurs, "but my mom wants me to, more and more."

I wonder how winning such a prize so young will affect this lad's life. Then I wonder what's for dinner.

Steve Lott's Hawaiian Pizza won a scholarship worth $10,000; he may be spending lots of time in the kitchen.

Remember on Saturday afternoons, when you were a kid and Stan Musial, Duke Snider and Roy Campanella would come up to the front door and ask you to come out and play a little ball?

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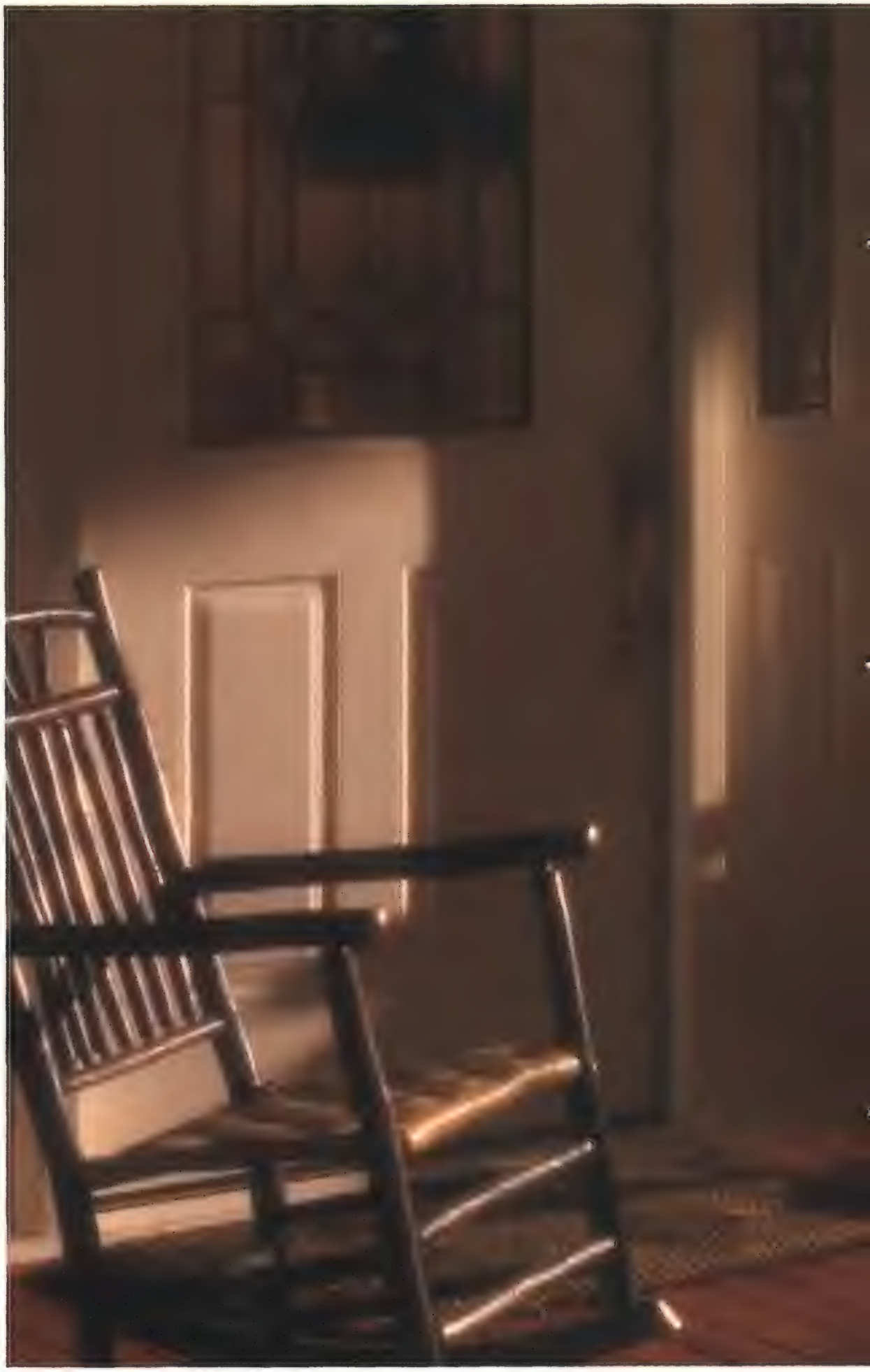

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Photographs by Mickey Pfleger

Their spheres reflect the order of the cosmos

Inspired by San Francisco's Exploratorium, science museums across the country are finding a world of lessons in soap bubbles

Most days, attorney Sterling Johnson concentrates intently on the serious consequences of torts and briefs and statutes. Today, though, he's attempting a momentous, if apparently silly, first in human history—to step out through the wall of a giant soap bubble without popping it. Here in San Francisco, reporters, TV crews and the audience at the Exploratorium's Second Ever Bubble Festival all watch as he strips to a swimsuit and cap, then allows himself to be drenched in sticky, slimy, soap solution. "Every follicle has to be wet," he later explains. "Some people ask, 'Don't you need to clip your toenails?' but that's before they've learned much about bubbles. Soap film doesn't know dull or sharp, only wet or dry. If it's really soaked, you can even stick a knife through a bubble and not pop it."

Johnson, now encased in the bubble, slides a hand through the film, then a foot—as if he's trying to sneak out before it knows what's happening. His torso follows, and the crowd, convinced he's made it, bursts into wild applause. "The reporters said I was entirely out before it popped," he says. "But I'll always wonder if my foot was still in the wall when it collapsed."

Such stunts are fun but not frivolous. The Exploratorium, after all, is a serious science museum. The starting point of its 650 hands-on exhibits, however, is the simple joy of empirical observation, and since the First Ever Bubble Festival in 1983, Exploratorium halls have been foaming with dozens of lessons in chemistry, physics, geometry and mathematics, all from simple soap film. Festival lecturers have saluted the prevalence of bubbles (or at least bubblelike structures) in just about all of nature. One even posited that the Universe itself is composed of megabubbles with all the galaxies gathered on their surfaces. And now, numerous other museums, like the Franklin Institute

A man who loves the feel of soap, Sterling Johnson blows them by hand at the 1988 Exploratorium festival.

Rapid changes in surface thickness create wondrous patterns and colors in bubbles from ordinary dish soap.

A quartet of Exploratorium visitors blows into a giant soap film that was lifted on a rod out of a solution-filled trough.

After dipping his samurai ring-sword in soap juice, Japan's Hiroyuki Sugiyama waves up a veritable bubble storm.

Bubbleology's sage, Eiffel Plasterer, has performed at science fairs since 1932.

Richard (Professor Bubbles) Faverty kneels under arch in which he has enveloped Amanda and Taiowa Steele.

By launching this ungainly monster, Taiowa appears to defy film's tendency to seek minimal surface area.

in Philadelphia, the Pacific Science Center in Seattle, and the Louisiana Nature and Science Center in New Orleans, are floating their own bubble festivals.

Contrary to what most people think, it's the relative lack of surface tension in soap film that enables it to form bubbles. They're mostly water, but the molecular bonds in H_20 itself are too strong to allow stretching into a thin film. Soap molecules are long strings of carbon and hydrogen atoms, one end of which is hydrophobic. As a result, they migrate to the surfaces of the bubble film, thereby pushing the water molecules inside. This reduces both surface tension and evaporation, which is a major enemy of bubbles. Even the weaker molecular bonds of soap solution work to pull it together into the smallest possible volume and surface area. Like other liquids, it wants most to be a drop, but will—because of its relatively weak surface tension—allow itself to be stretched into a film. Still, since the film also seeks a structure with the smallest surface area, namely a sphere, with steady blowing it decides to cooperate and become a round bubble.

A tiny rupture explodes into a soapy shower

The skin of a bubble capable of floating in air is only a few millionths of an inch thick. Evaporation makes it even thinner until, typically, something very dry, like a dust speck, comes along and suddenly evaporates a hole. The turbulence of air rushing from the inside of the bubble through the hole, in combination with the pull of the liquid's molecular bonds, shatters the surface tension, and the soap solution splits into thousands of droplets, again seeking minimal volume and surface.

Though evaporation destroys bubbles, it, along with drainage due to gravity, also gives them their wide spectrum of colors. Light waves are reflected from both the outside and inside surfaces of a bubble's skin; as a result they interfere with one another—their crests and troughs get out of sync. With ongoing changes in bubble-wall thickness, a variety of wave interference patterns, and therefore colors, occurs.

Understanding why a bubble shimmers so beautifully won't help Johnson in his next attempt to slip through one, but knowing how its molecules hold together will. "I'm looking for a place with really clean, humid air, and practicing smooth movements that will least disrupt the bubble's surface tension. I'll probably wear a wet suit, though sometime I'd like to do it bare-skinned." At future festivals, performers will no doubt show off an increasingly amazing variety of novelties and tricks. But they all agree it's the very evanescence of bubbles that draws our attention most. "You know you have to focus and look quickly, to appreciate the moment," says Johnson. "In an instant, it's gone."
Bruce Hathaway

Johnson and son, Ian, show festival participants how to blow small, "handmade" bubbles inside larger one.

Light waves reflecting off both outside and inside surfaces combine to generate a rich palette of colors.

Sugiyama metamorphoses into a bug-man as his brother Teruyuki blows smoke-filled bubbles onto his glasses.

Amanda learns what happens when bubble surface tension yields to dryness of a dust speck in the air—pop!

By Michael Parfit

The only substitute for an old DC-3 is another old DC-3

After 53 years of service, the legendary Three is still Number One with the pilots who fly it and the mechanics who keep it in shape

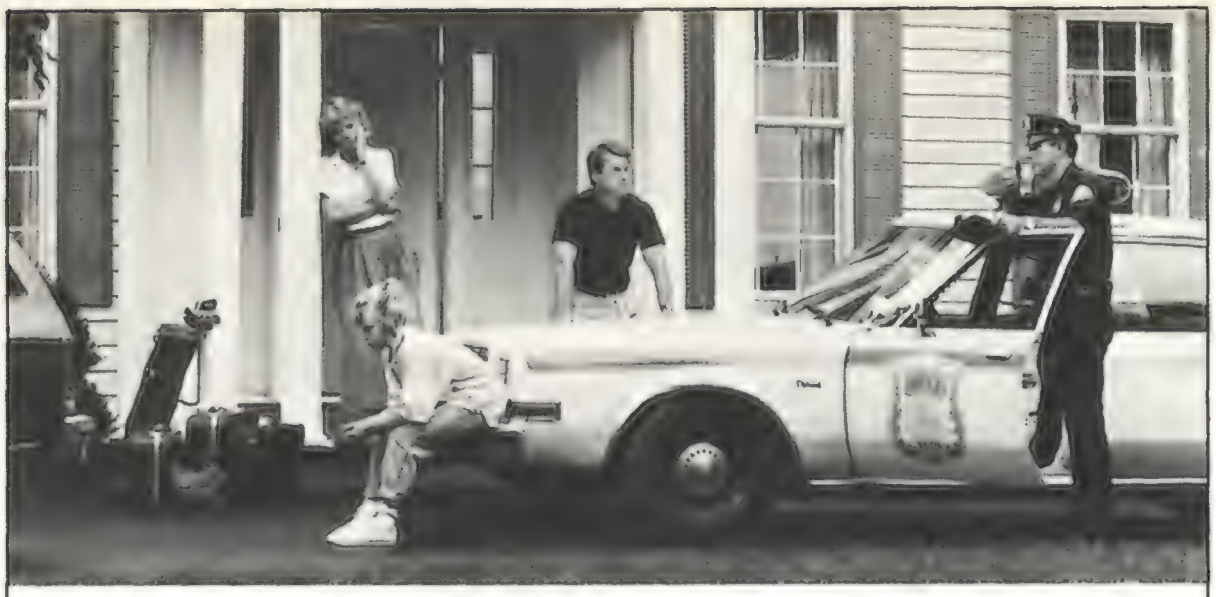
Opposite: Salair Inc. mechanic Duane Oester updates equipment in nose of aging DC-3 used to haul freight. Gleaming Threes and "Skysleepers" on La Guardia Airport strip (above) flew passengers, mail.

"I have it on good authority," Ken Lemon said, listening critically to the clatter of the two engines, "that when Christ comes back, He is coming in a DC-3. He can land anywhere, and He knows He will get there, too." A little later, as the big, old plane he was flying rumbled slowly along above western Wisconsin, he said something else. "You," he said, pointing abruptly at me where I sat in the jump seat behind the pilots, "are going to fly us back."

It was a cargo run out of Oshkosh. The Ford Motor Company needed 5,000 pounds of parts moved from Minneapolis to Kansas City before sundown. The call came to Basler Flight Service Inc. of Oshkosh, and ten minutes later pilots Ken Lemon and Scott McCulla had jumped into N97BF, one of several Basler freighters, and headed for Minnesota. I had gone along for the ride in the distant hope I might get to realize an ambition of many years: to fly the world's first great working airplane.

This was a dream I shared with millions. You don't have to be a trained aviator to long to fly a DC-3. The thought has run through generations. *Tapocketa, pocketa, pocketa.* "To hell with the ice, Junior. We're going through." I'm a run-of-the-mill private pilot; for me to dream of flying a DC-3 was like a model-train hobbyist hoping to be an engineer on the Orient Express. But now, since Lemon was a certified instructor, it was going to happen.

The evening before, I'd flown my own small, single-engine Cessna to Wittman Field at Oshkosh and parked on the ramp. In the amber shine of big streetlights, the ramp looked like a flashback to the 1940s. It was covered with DC-3s. Late at night, I had walked around N97BF, admiring the immortal lines: a rounded fuselage tapering smoothly from the snub nose; the authoritative tail; the two big main tires and a hefty tail wheel; muscular engine nacelles, each with an open ring of cowl flaps, like a skirt; the long, tapered,



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aluminum wing, swept back on the leading edge and slanted upward. In the red-gold light, the thousands of round-headed rivets on the wing shone like drops of dew.

It was the mold that, in one way or another, shaped everything that followed. In 1932 nobody was sure what a high-performance, working aircraft ought to look like. People thought maybe the fuselage should hang down from a big, flat wing. They thought it ought to carry 10 or 12 passengers and a few sacks of the precious mail that subsidized the business of flight. They knew it should be safer than what was then state of the art: the whole fledgling air-transportation industry had just been shaken to its foundations by the 1931 crash of a Fokker trimotor that killed Knute Rockne, the famous Notre Dame football coach. Despite that, they still thought it should have an engine on each wing and a third one on the nose. In 1932, Transcontinental and Western Air, the predecessor of Trans World Airlines (TWA), asked aircraft manufacturers to submit proposals for a new trimotor airliner. It took a lot of slide rule manipulation for the young Douglas Aircraft Company to persuade TWA that two bigger engines would be enough. The plane, TWA demanded, had to be able to climb on one engine over the 8,000-foot segment of TWA's route near Gallup, New Mexico. "If you can do that," Charles A. Lind-

Pilot Ken Lemon steadies rudder with block while unloading in Kansas City.

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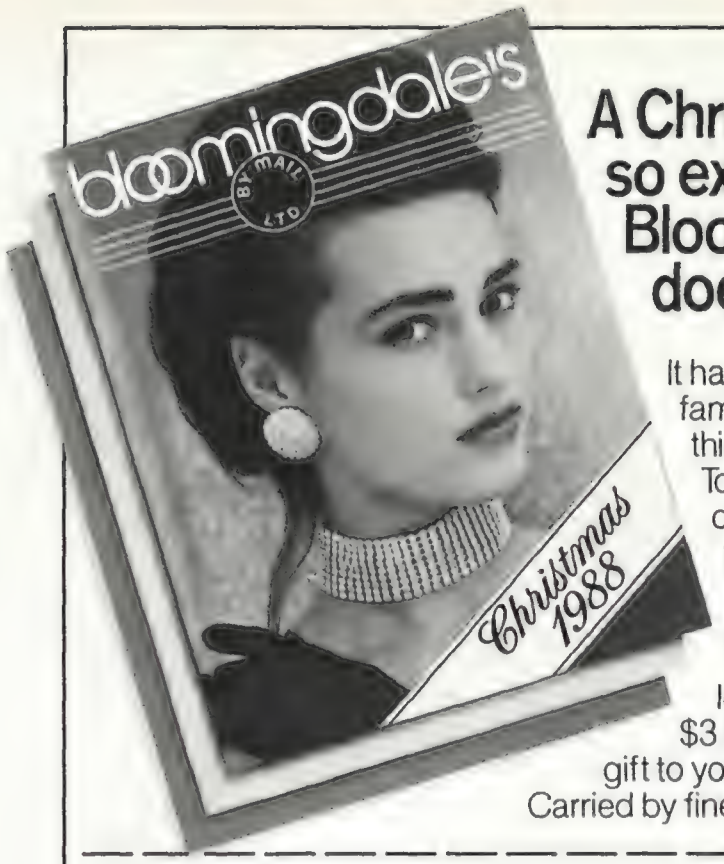

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bergh, a TWA adviser, told a Douglas engineer, "we'll buy the design. If not, we'll go elsewhere."

When you look back on the creation of a perfect tool, it often seems to have leapt whole from the mind of its inspired creator into widespread acclaim. That wasn't true for the DC-3. No one planned to create the single greatest aircraft design in the history of flight. It was more as if a collection of different tunes had come together for just a moment to make a short harmony whose resonance would echo for decades.

Here were the airlines, ready for a new plane. Here was Douglas, loaded with young engineering talent. Here was a new wing idea, developed by John K. Northrop, in which the whole framework of wing and aluminum skin did the work previously assigned only to cumbersome spars. Here were new, more-powerful engines being made by two competing companies, Wright and Pratt & Whitney. Here was a throng of aeronautical concepts and materials waiting to be joined in the right bird: wing flaps, a new aluminum alloy, controllable-pitch propellers, toe brakes on the rudder pedals, retractable landing gear.

Many of these helped to create the lone prototype DC-1 (DC is an abbreviation of Douglas Commercial), which first flew in the summer of 1933. They were subsequently incorporated in the DC-2, which was so successful that when American Airlines asked Douglas to widen the fuselage in order to accommodate sleeper berths, the company was reluctant to commit the time and facilities. But American agreed to buy 20 of the new planes and on December 17, 1935, the first DC-3 wearing American's colors, the Douglas Sleeper Transport (DST), took off for its first flight from a short airstrip in Santa Monica, California.

Michael Parfit adapted this article from his book Chasing the Glory: Travels in America, *which is due out next month from Macmillan.*

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Modernized controls include long-range navigation system (box below the compass, top center) and fan-shape weather radar screen (center right).

In June the plane was unveiled to the public at an airshow in Los Angeles. Donald Douglas was wryly chagrined to notice that the sign in front of it read: "DOUGLAS DC-3: 14 BIRTHS OR 21 SEATS."

The moment of harmony had occurred, but no one heard it. Douglas still figured the DC-3's future was limited. "We didn't believe the airplane was going to sell," said Malcolm K. Oleson, who was then a young engineer with the company. "Everybody thought it was too big." Oleson had sneaked away from work to see the new plane fly. Barely seven years later, he became chief project engineer for the Three, which had already revolutionized aviation. Douglas considered the DC-2 a hot item; it sold 156 copies. By the time the United States entered World War II in 1941, the airlines had ordered more than 500 DC-3s.

"It was a very reliable airplane," Oleson told me when we got together one day at the airport where the DC-3 had made its first flight. "It was one of the first airplanes with soundproofing. It was one of the first airplanes that could maintain cabin heat so it wouldn't freeze you when you went up high. It would carry a load that you could make a profit on—the operating cost was not much greater than the Two, but it could carry seven more passengers."

That was the key. The DC-3 was the first plane that could make it without the subsidy of government airmail. By 1941 the Three (and its predecessor) had won contracts from airlines worldwide, had set records and won awards, but it won its real glory in World War II. The plane Lemon and McCulla flew across Wisconsin that day did not start life as a civilian DC-3. It was a military C-47 (C stands for cargo), one of the more than 10,000 of the many DC-3 variations that Douglas made for the Armed Forces between 1941 and 1945. This one, N97BF, was built in 1944. It was a "Dakota," the British name for the design. Basler Flight Service had recently bought it from the French Navy. It still had a dome on top for the navigator to get sun and star sights. It still had plastic grommets in the passenger windows for troops to stick their rifles through and fire at the enemy. "You had to train the

Could a cat that eats supermarket pet food take this test and land on its feet?

1. Feel skin and coat. Comb your fingers through the hair. Is it:

A. Healthy, vibrant and free of flaky deposits. 30 pts.

B. Dry, lackluster and poorly elastic. 5 pts.

C. Very oily, smelly, or uneven. 0 pts.

There are normal variations in different breeds of cats at different times of the year. However, poor nutrition always adversely affects skin and hair.

2. Inspect mouth. Raise your cat's upper lip to view the teeth. Are they:

A. Clean, white and glistening. 20 pts.

B. Yellowed with signs of residue. 5 pts.

C. Decaying with evidence of tartar. 0 pts.

Diet plays a major role in oral hygiene. If you didn't check A, chances are you feed your cat a steady diet of wet foods, which can result in dental problems. Dry foods help cleanse teeth and gums.

3. Monitor appetite. Does your cat eat:

A. Many times a day from a single serving. 20 pts.

B. Once a day. 5 pts.

C. Once every other day. 0 pts.

Many feedings a day are preferable because it allows for more efficient digestion and utilization of food.

However, if your cat suddenly changes eating habits, consult your veterinarian. It could indicate a health problem.

4. Examine stool. Stool size, consistency and odor are good indicators of a cat's overall well-being. Is it:

A. Small, firm and free of any unusual substances and odors. 30 pts.

B. Large, hard with an offensive odor. 5 pts.

C. Very large, soft, with an offensive odor. 0 pts.

Stool volume is largely influenced by undigestible foods and enzyme deficiencies.

Small, firm stools demonstrate your cat has properly assimilated all the essential nutrients.

Stool consistency indicates the quality of your cat's source of nutrients. Stool from a poor source may be soft.

A hard stool can represent a mineral or fiber imbalance.

Stool odor is usually traced to grain-based cat foods sold in supermarkets.

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troops not to shoot the airplane," Warren Basler, the head of the company, told me.

The DC-3 developed an almost supernatural reputation in the war. It carried enormous loads, survived mid-air collisions and routinely struggled over the Hump, as the Himalayan air route across China, Burma and India was called. Once, one flew with hundreds of bullet holes all patched with cloth; when it slammed into a tropical rainstorm, the patches washed off and the plane became forever known as Whistling Willie. But it made it home. Gen. James H. (Jimmy) Doolittle once told Douglas he had been evacuated from Burma in a DC-3 that contained "21 women, 21 children, 10 Indians, 21 soldiers and 1 exhausted lieutenant colonel named Doolittle." After the war a pilot told Oleson about an encounter with an enemy fighter. The fighter came around on the Three's tail and was ready to blow it out of the sky. "So," the pilot said, "I snap-rolled it." A snap roll is a small-plane maneuver; you'd expect it to bend a transport's wings. The pilot grinned at Oleson's surprise. "Does a beautiful snap roll," he said. "Lost him, too."

Shortly after the war the federal government tried to retire the DC-3, but changed its mind after a storm of protest. Since the mid-1950s, magazines have been publishing elegies as if the plane's life were over. Produc-

Copilot Scott McCulla waits for cargo; he'll make sure it's evenly distributed.

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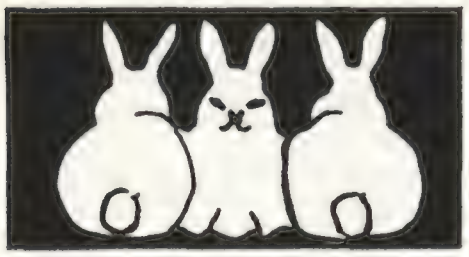

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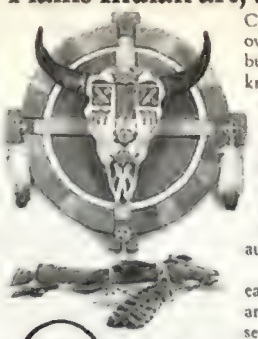

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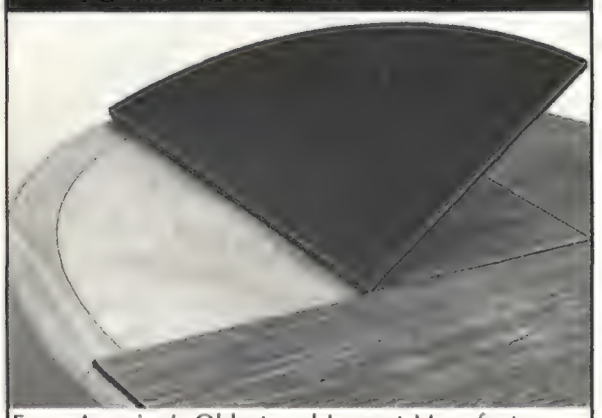

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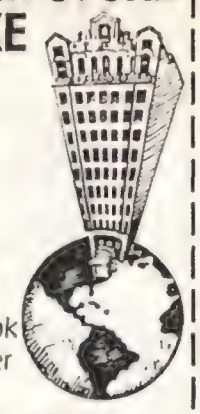

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After DC-3 flew 56,782 hours, Eastern Airlines gave it to Smithsonian in 1952.

tion of the original DC-3s ceased in late 1945. The DC-3 that hangs in Smithsonian's National Air and Space Museum (above) was donated by Eastern Airlines in 1952. But here I was in the late 1980s, several years after the 50th anniversary of that first flight, flying in a DC-3 that was still on the job.

The wind was gusting to 20 knots at Minneapolis. As we descended, McCulla fought the wheel. He and Lemon made a typical pair of DC-3 pilots: the Veteran, the Kid. Lemon was 44, large, balding, deliberate. Scott McCulla was 20. He had a fair face, tousled fair hair, fair stubble. He wore a T-shirt printed "Old Rhinebeck Aerodrome." No epaulets in this business. McCulla's father is an airline pilot. McCulla had gone directly from flying tiny Cessna 150s into the DC-3 copilot's seat. He was slightly in awe. "You always see these airplanes in movies," he said.

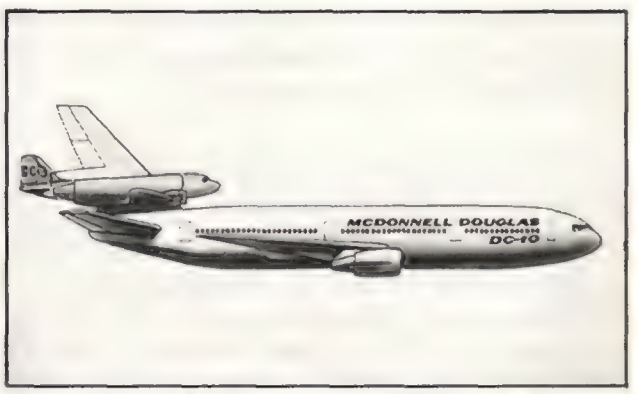
Minneapolis came bouncing up toward us, its dark, jagged skyline out the right side, its airport ahead, a big clearing between the Mississippi and Minnesota rivers. "Gear down," McCulla said. In my Cessna the landing gear is operated by a switch. In the DC-3 it is controlled by a pair of metal levers that Lemon compared to an oversize screen-door latch. He worked it like a handbrake.

McCulla landed straight down the runway, dancing a jitterbug on the rudder pedals. We taxied to the gate. With its tail on the ground, the DC-3's nose was as tall as a 727.

McCulla and Lemon jumped out and helped load the plane. The pallets of auto parts were strapped down in the big, hollow tube of the fuselage. The Pratt & Whitneys started with puffs of blue smoke. We took off for Kansas City. We had been on the ground for just ten minutes.

An estimated 1,200 DC-3s are still flying all over the world. They were used in combat by the U.S. Armed Forces as recently as the Vietnam War, where they rained fire from their open cargo doors. Those DC-3s were nicknamed Puff the Magic Dragon. Since then the Threes have run weapons for Contra rebels, run drugs for society's rebels and run auto parts all over the place for the Establishment. One U.S. airline, Eastern Express, still uses ten DC-3s for its regular service in the Northeast. A DC-3 converted into an experimental trimotor, with turboprops in the wings and nose, has flown tourists to Antarctica, and research groups to the Arctic. DC-3s are used in the overnight air freight business, to haul fresh fish in Alaska and to drop firefighters over wilderness smokes. I had visited one of several U.S. Forest Service smokejumper bases in McCall, Idaho, before I got to Wisconsin, and one afternoon I stood by the cavernous open door while trainees stepped to the roaring aperture, paused, then disappeared. "The only replacement for a DC-3," the pilot of that flight had told me, "is another DC-3."

But that, of course, makes you wonder. How can these planes hold up?



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Passengers relax aboard United Airlines Three in a late 1930s publicity shot.

The answer is, sadly, nothing lasts forever, particularly engines. As we flew south now across Iowa, the turbulent air slugged the plane around, but the two old Pratt & Whitney R-1830 radial engines rumbled reassuringly on. At least *I* thought the rumble was reassuring. Lemon and McCulla kept looking out their windows at the engine nacelles and observing with apparent skepticism, "My side's still dry." They were looking for the gush of oil that might give warning of engine failure.

DC-3 pilots once had a slogan for their faith in these engines: "Trust in God, Almighty Pratt & Ever Grateful Whitney." But all those DC-3 engines are ancient now, and have been rebuilt again and again. The plane itself goes on and on, but the engines are getting tired. "The only thing that will stop the DC-3 from flying is the engines," the chief mechanic for Eastern Express had told me when I dropped into his shop. And even people who can repair DC-3 engines are getting scarce.

"They show you an engine like this in school," said a mechanic with Salair Inc., a freight-flying business based in Seattle that owns eight DC-3s. "They tell you: 'This is a radial engine. You aren't going to see any.' " The Salair mechanics were a wonderful, raffish bunch who worked painstakingly at their old machines as if their job was also their hobby. Indeed, big engines

World War II troops were crowded into C-47, a military variation of DC-3.

seemed to suit them; after working all morning on the DC-3 radials, they jumped on burly Harley-Davidson motorcycles and roared off to lunch.

Basler Service gets 1,600 hours out of an engine and tries to rebuild it before it quits on its own. Still, even on the best-maintained aircraft, the reassuring rumble sometimes clanks into silence. "If you fly these long enough," Lemon said, "you don't have to wonder *if* you're going to lose an engine. You just wonder *when*. You fly with the assumption in the back of your mind that an engine is going to shut down at one of the most inopportune times."

Fortunately, the DC-3 will fly all day on one engine. I wouldn't have been riding there looking out at Iowa over Lemon's shiny head if it had been any less capable. When I was 12 years old, I was sitting at the window of a DC-3 at night over the jungle of Brazil when flames started pouring out of the engine on my side. I was not very happy then, and was less so when the stewardess came running back through the cabin, looking out the windows as if searching for a place to jump. Then the propeller stopped. The cabin became very quiet. In the next half-hour that DC-3 became a church. But 40 minutes later the plane drifted easily down into the haloed lights of São Paulo.

Sometimes DC-3 passengers aren't so lucky. Once, when one of the For-

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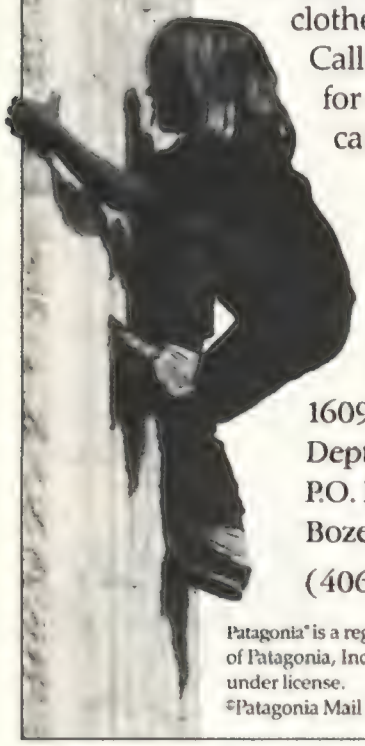

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est Service's DC-3s was flying over the magnificent Idaho wilderness, piloted by a friend of mine, its two engines quit at about the same time. One of them fell off. A photographer hiking in the woods that day took an amazing photograph. It showed the engine falling out of the sky like a meteor, and the unmistakable silhouette of the DC-3 in the distance, still level and aloft (p. 162). The plane looked confident and stalwart, in spite of its wound. That DC-3 wing provides plenty of lift for gliding. My friend and his captain needed a long glide. After the second engine quit, they flew for about five more minutes, looking for a flat place along the Selway River. They almost made it.

A backpacker walking along the side of the hill saw the plane go past, still level at about 200 feet. It was eerily quiet, he said later. It made only the sound of wind. Inside, someone testified later, there was no singing, no praying. "We're going in," one of the pilots said. "Link arms." The smooth river lay ahead. But the plane caught a wing on a tree. The backpacker heard the sound of a crash. After a while he saw bits of fuselage swirling down the river. The only survivors were two people and a dog who were sitting in the back.

But passengers who get into DC-3s today needn't hold their breath. Flying in one is still safer than highway travel. Under the airline rules that Basler adheres to, many parts are replaced after a strict number of flight hours, whether they're worn out or not. Inspections are frequent and inspection routines are intricate. Basler's maintenance chief participated in the recent production of a new inspection manual for the DC-3, which tells mechanics where to look for corrosion, fatigue and other gremlins of age. "You have to ask what, after 50 years, is original on the plane besides the nameplate," said a Federal Aviation Administration engineer. "It's gone through engines, landing gear and so on. And the DC-3 is probably

Aboriginals look over a C-47 that ferried personnel and supplies from U.S. Army bases in Australia to New Guinea battlefront in 1943.

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U.S. C-47s fly a resupply mission over France not long after D-Day invasion.

overbuilt. Hey, you've got safety factor like crazy."

As we floated along in N97BF above Iowa, that sounded good to me. Lemon was flying now, so McCulla handled the radio. The radio did the same thing to him that it does to all aviators. Once he pushed that transmission button the eager kid was transformed into an old man, the bored captain of 10,000 flights. "Good evening, Minneapolis Center," he said. "Dakota niner seven Bravo Foxtrot with you." He didn't say, "Niner seven Bravo Foxtrot is flying south on a beautiful evening, with the last clouds fading from the sky and the land becoming golden beneath us, and there is nowhere else in the world we would rather be." But that's what was happening.

In the DC-3's days of glory, when radios were rudimentary and unreliable, the land was loved not only for its grandeur and beauty, but also for the landmarks it offered: that ridge of trees, that junction of rivers, that island shaped like a dolphin. The plane that changed the world was on intimate terms with the landscape. It touched you; you touched it. "I hit a duck once," Lemon said, munching on a sandwich. "Right here." He pointed to the left window. "Didn't even crack it. I went on instruments with blood and guts all over the windshield."

The air was bumpy. The land was bumpy. We flew at 6,000 feet, down there among the humps of land and air. Clunk, bang, thump. It was as if we were in a two-mile-long truck, bumping along over a corrugated landscape. It was great, and I could tell Lemon thought so too.

"You can either have fun until you're 60 years old," Lemon said, "and then not have any fun when you retire because you're broke, or you can put up with a boring job and then have fun because you saved a lot of money." His choice was obvious. "No one gets rich doing this kind of flying," he said, "except the man that owns the airplane." The radio squawked. Lemon checked in with Kansas City Approach. "I have to admit," he said, "when I wake up in the morning I smile because I get to go to work."

We landed at Kansas City and unloaded the parts. Then it was my turn to go to work. I belted myself

Combining truck chassis with DC-3 fuselage, family made a mobile home.

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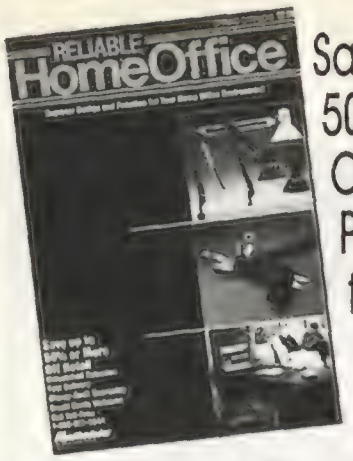

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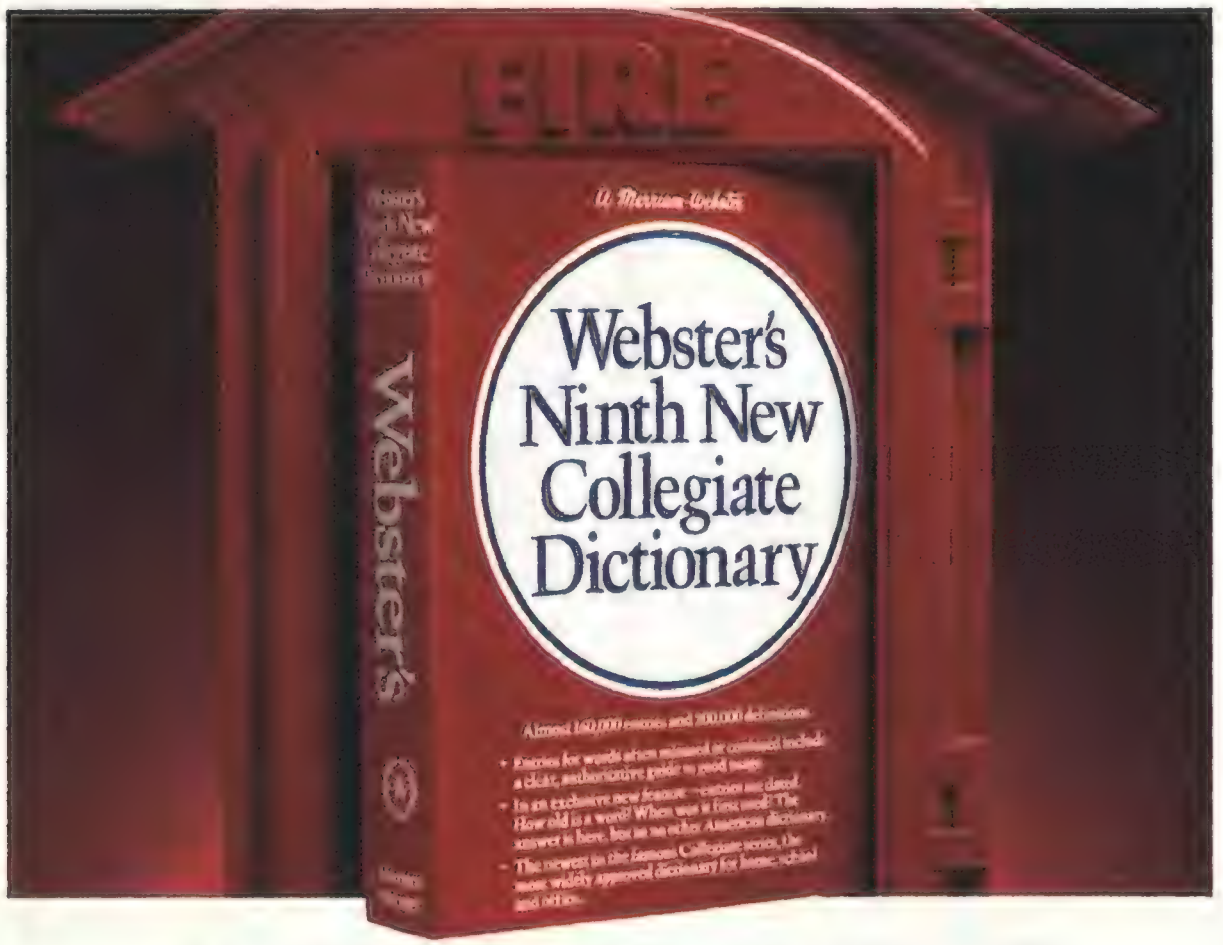
While its engine falls to earth, DC-3 glides over Idaho wilds prior to crash.

into the copilot's seat. I am the most basic kind of pilot: I fly small, single-engine planes with wheels that don't even fold up. I was now going to fly a two-story building. Lemon had put on his instructor's hat. "The controls are the same as you're used to," he said on the intercom. He was didactic now. "Rudder pedals, control wheel, elevators, ailerons. But the airplane will respond much slower to the control inputs than what you're used to. So even though it's a slow airplane, you have to plan further ahead of it.

"It's easier to land than your Cessna," he went on. "But if it gets away, it gets away *larger*. It happens in slow motion. Everything in this airplane happens in slow motion. But the corrections happen in slow motion, too. So when it begins to lose directional



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control on the runway, it does it in slow motion, and it's almost laughing at you: 'Ha . . . ha . . . ha.' "

The engines rumbled up, clattering as if the cylinders were full of loose bolts. Needles in the instruments moved to their appointed places. The wheel was heavy. It was built like two-thirds of an automobile's steering wheel. It was old-fashioned. It was not a wheel to caress. It was a wheel to do business with.

The plane began to move. Then it veered slightly to the left. I corrected. I overcorrected. "Ha . . ." The plane veered to the right, ". . . ha." I danced on the pedals. The plane settled down. I pushed the stick forward. The tail rose. Slowly the DC-3 accelerated. Still on the wheels, we were so far from the ground that 84 knots seemed a stroll. But the speed was sufficient, so we just strolled up into the air.

We rose, big and buoyant like a blimp. Lemon raised the landing gear. I remembered something Oleson had told me. The DC-3, he said, is not the perfect flying machine. The rudder's heavy, and at high speed the ailerons feel as if they're buried in concrete. Put it in a steep sideslip and the rudder will lock over on you and get aerodynamically stuck; you can get out of the problem, but you'd better not do it at a low altitude. If you load the fuselage too far aft it becomes unstable, and you may find its nose rising in the air even as you push the stick forward. But it was still a

Handler loads computers into hold of DC-3 at airport in Spokane, Washington.

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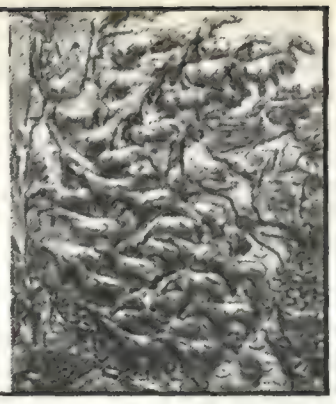

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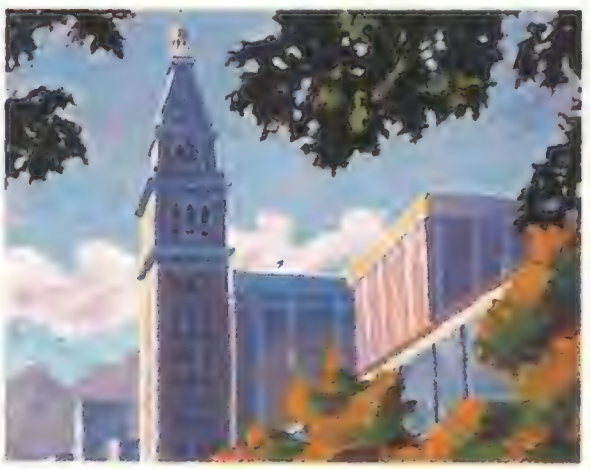

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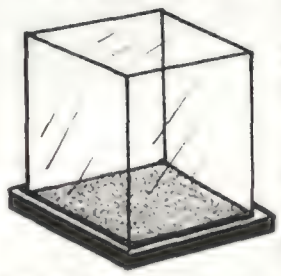

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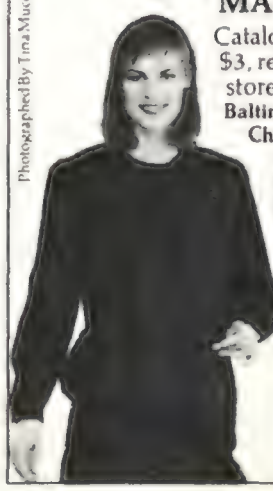

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making. I doubt whether any airplane will have the same impact, or the same opportunity, again."

The setting sun drew a red arc on the outer edges of the propellers: state of the art. We climbed to 8,000 feet and, with altitude, prolonged the day in the evening's high pasture. A fleet of thunderstorms sailed along the horizon to the south; we flew near the base of a scattered layer of cumulus clouds that were drying into shreds.

It was peaceful out there, as we rumbled past. Other aircraft checked in regularly on the radio, but all the voices seemed unhurried, content. In this early evening, the great passenger liners of the high altitudes were sailing above the world on their long arcs, cleared direct from Denver to Kennedy and getting close to home. The commuter planes were hauling their after-work passengers to Chicago, Kansas City, St. Louis, Omaha. The freighters, the mail planes and the little bank planes ferrying canceled checks had picked up their cargo, and had all taken to the marvelous, clean, calm sky. For a few minutes it seemed as if the whole community of pilots was aloft, each one of us at peace, moving gently across the beauty.

The DC-3 and I were comfortable with each other. The little room of the cockpit had become a pleasant and familiar place, with instruments I understood informing me of our collective health, and switches and devices to manipulate that protected my life and gave me joy. Later I would land the plane without effort or drama on the lighted Oshkosh runway. But this was the special time, a time to remember forever.

Late that night, after the landing, we got out of the DC-3 quietly. Even with the ground beneath your feet it's hard to break the membrane of flight. We left the plane and walked slowly back toward the bright office. We didn't say much. Pilots love to talk about the near misses, but they keep the drama and beauty of their everyday lives to themselves.

The lights of the office brought us back to the dazzle of the real world. "It's an enjoyable job," Lemon said as he closed the books and got ready to shut the place down, "if you can stand the on-call thing." He told a story about being called in the middle of the night for a bad flight in a snowstorm. He grinned. There was, after all, a reason why he was still doing this kind of work after 20 years as a professional. The magic had not gone out of flying a DC-3. "There's still some romance in it," he said. "It's still two guys flying through the night in lousy weather, loading the freight and flying off somewhere else."

Retired DC-3 on display in Ushuaia, Argentina, appears fit enough to fly again. A total of 10,629 civilian and military Threes were built; today, 1,200 are still flying passengers and freight all over the world.

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A Message from Robert H. Kline
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I display my own *Seven Ages of Man* tableau in an etagere, where room light pours through it. Guests never cease to marvel at its beauty and elegance... nor to exclaim at the way the stained glass seems to live and breathe with changes in the light.

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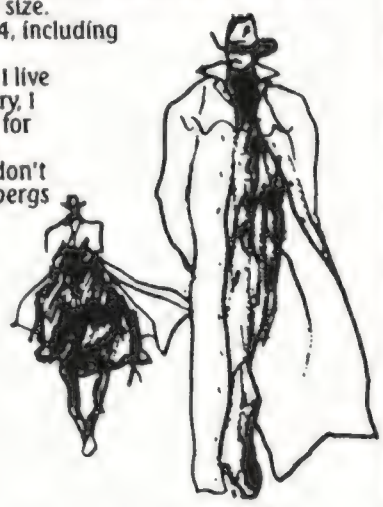

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Book reviews

Dead Man's Chest: Travels After Robert Louis Stevenson
Nicholas Rankin
Faber and Faber, $25

Robert Louis Stevenson belongs to that select group of writers loved by people of all ages. Toddlers still listen enthralled to *A Child's Garden of Verses*; no boy's adventure story matches *Treasure Island*; and few adult shockers compare with the deliciously creepy *Strange Case of Dr. Jekyll and Mr. Hyde.*

Inspired by conversations with the late Argentine writer Jorge Luis Borges, Nicholas Rankin had the good idea of writing a travel book cum biography by visiting all the places where Stevenson lived. The British journalist's technique is simple: he journeys to a site, relates Stevenson's experiences there and compares them with his own in the 1980s. This approach—partly borrowed from the classic *Quest for Corvo* (in which A.J.A. Symons chronicled both the life of a fin de siècle eccentric and his own misadventures while researching the biography)—naturally results in a somewhat rambling, highly anecdotal style.

For a man who died at 44 (in 1894) Stevenson certainly got around: Edinburgh, London, France, upstate New York, California, Hawaii, Australia and, for his final home, Samoa. Rankin latches on to telling details in all these places. After visiting a lighthouse built by Stevenson's grandfather, he observes that the writer was the only Victorian novelist of note to go underwater in a diving suit. (One pauses at the thought of Henry James in such gear.) While residing in the seaside resort of Bournemouth, R.L.S. made friends with the son of Percy Bysshe Shelley and heard

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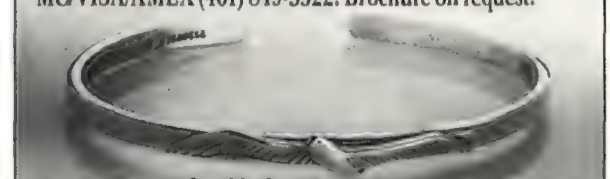

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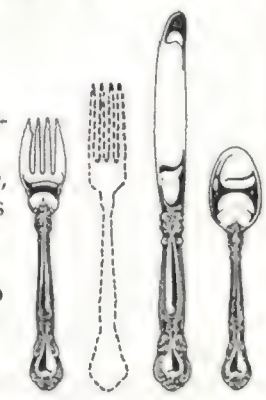

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himself acclaimed as that poet's reincarnation. The Saranac, New York, sanitarium where he lingered was established by the great-grandfather of Garry Trudeau, the creator of *Doonesbury*.

Rankin's own excursions and encounters can also charm. For instance, Roger G. Swearingen, the leading Stevenson scholar in the United States, drives a classic street machine—a 1957 Chevy Bel Air, the "only car he has ever had." Graham Greene once planned to write the biography of R.L.S., his "first cousin, twice removed." Sometimes, though, it seems that Rankin's passion for the past only leads to grousing about the present: he decides not to visit the Cévennes because the area is overrun with tourists; America is a neon, drug-crazed wasteland.

Stevenson himself observed that "sightseeing is the art of disappointment." And these days readers are used to sour travelers—Paul Theroux springs instantly to mind. In reply, Rankin might say that Stevenson himself was no dreamy, romantic wanderer (as he is often portrayed). He rejected his father's religion, married a divorced woman ten years his senior and bravely visited Father Damien's leper colony on Molokai. His Samoan books—*The South Seas*, for one—stand as manifestos in colonial history, pleas for native sovereignty from one honored as Tusitala (Writer of Tales) and revered as chief.

So despite the occasional griping, *Dead Man's Chest* remains an effective homage from a modern journalist to a favorite writer. Readers will be led back to Stevenson—to the magical tales of the *New Arabian Nights*, to the masterly "Beach of Falesá," to the unfinished *Weir of Hermiston*. For this alone, Rankin's trip—even after all those nights in cheap hotels—definitely will have been worth it.

Michael Dirda
Editor for *Washington Post Book World*

Nora: The Real Life of Molly Bloom
Brenda Maddox
Houghton Mifflin, $19.95

"It is just as well my husband didn't have a literary wife," Nora Joyce once told a young scholar. "There had to be somebody to do the cooking and wash the dishes." As Brenda Maddox shows in this biography, cooking and washing up were the least significant of Nora's functions. In fact, because the family frequently lived in hotels and furnished rooms, Nora did fewer housewifely duties than many married women. Instead, she served James Joyce's emotional needs in a way that probably no other woman could. "Nora's responsibilities were to feed Joyce, hold his hand, choose all his clothes and the children's and keep them in order; to accompany him wherever he went socially, to cut him down to size, and to reassure him, every time she opened her mouth, that Ireland was not far away. Joyce never asked more of her, and nobody else dared."

Nora Barnacle and James Joyce eloped from Ireland in 1904 and, except for a few brief visits, never returned. They were not married; they did not marry until 1931, and only then to give their children legitimacy. They were an unlikely couple: Nora was strikingly attractive, uneducated and flamboyant. James Joyce was a linguist, a scholar and a writer, a slender, fragile-looking man whose thick glasses enlarged his cool

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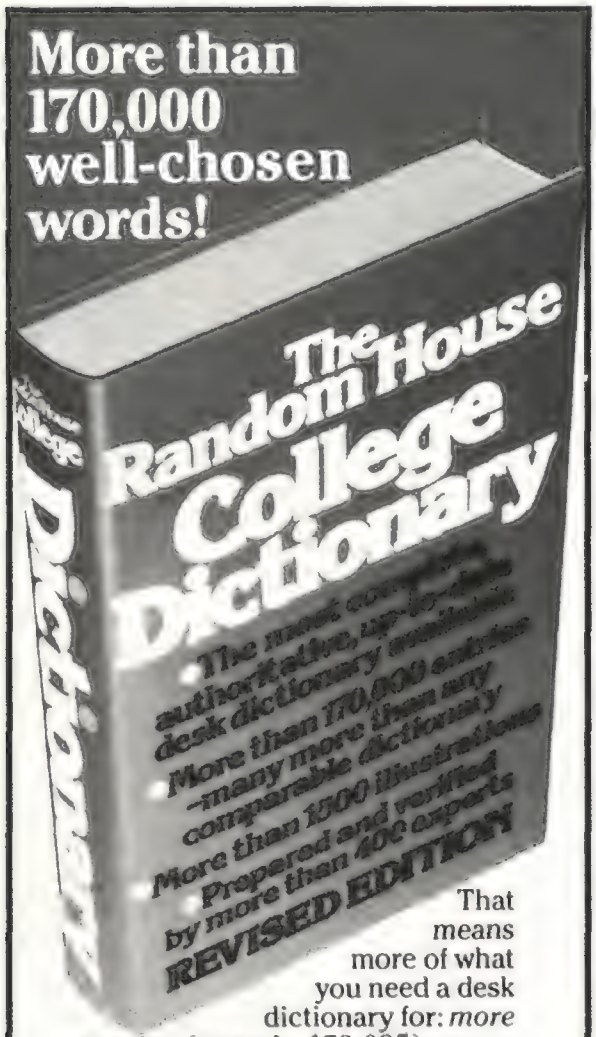

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blue eyes. Yet both were lonely; both longed to leave the provincialism of Ireland and the constraints of their Catholic upbringing. Both were rebels.

Their early relationship is well-documented by letters that reveal the sexual and emotional needs that each filled for the other. Maddox finds echoes of these letters in Joyce's major works, including "The Dead," *Portrait of the Artist as a Young Man* and *Ulysses*. She does not try to persuade us that Nora served as model for any of Joyce's women characters, but rather that Nora's sensibilities, even her way of thinking and talking, inevitably found their way into her husband's work.

Nora herself had little interest in those works. Although she was not as unliterary as some would have us believe (she loved opera, for example, and knew many librettos by heart), she found Joyce's writing often incomprehensible. He did not turn to her for affirmation of his talent. For that he had such patrons as Sylvia Beach and Harriet Weaver.

The children, Giorgio and Lucia, are portrayed here as victims of both parents. *Nora*, besides being a thorough biography of Nora Barnacle Joyce, is even more important as a portrait of a troubled family. Nora doted on her son, Giorgio, in a manner that seems almost seductive. She cared less for Lucia, who tried to establish the kind of relationship with her father that Giorgio had with Nora. But Joyce was emotionally absent. Even when he was around, he was intensely occupied with his writing. He thought nothing of taking his children out of school several times during the year and moving the entire family to a new city or a new country. He thought nothing of setting them down in an environment where they knew no one and could not speak the language. It is no wonder that they felt like permanent exiles, that they had few friends and withdrew into themselves.

Nora is a credible work of scholarship that undoubtedly will aid scholars in their exegesis of Joyce's often hermetic works. Maddox's interpretation of Nora's life is decidedly more feminist than that offered by Richard Ellmann in his noted biography of James Joyce, but it is an interpretation well supported by the memories of those who knew the Joyce family, by interviews and by letters. Maddox traces the publication of some of those letters in a fascinating appendix that illuminates the difficulties biographers face and the mysteries that they must unravel.

Nora's mysteries are dealt with fully here as Brenda Maddox reveals the extravagance, the madness, the passion of Nora Joyce's life.

Linda Simon
Teacher of expository writing,
Harvard University

Bernard Shaw: Collected Letters (1926-1950)
Edited by Dan H. Laurence
Viking, $45

On his 93d birthday, Bernard Shaw wrote a letter to St. John Ervine that began, "May I respectfully remind you that when Lincoln was shot . . . my age was 9 years, and my views on the subject so little in demand that I did not take the trouble to form any. . . ." It is difficult to imagine that, after 1865, there was any event or any subject on which Shaw did not form views and, demand or not, express them in plays, books, pamphlets, articles and letters. So many letters and such good ones.

The fourth and final volume of Shaw's *Collected Letters* begins a few months before his 70th birthday, in 1926, and ends in 1950, the year of his death. These were the years in which his once-startling plays became classics and his new plays were attacked by critics who dismissed them as unpleasant jokes; only now are works like *Too True to be Good* and *The Simpleton of the Unexpected Isles* being recognized as the quality goods they always were.

With the advent of the talkies, he became seriously interested in film (not in Hollywood, although he regularly flirted with one studio or another) and took an active part in bringing *Pygmalion*, *Major Barbara* and *Caesar and Cleopatra* to the screen. He saw through press the standard edition of his works, including collections of many of his fugitive pieces, and he published two large political books, *The Intelligent Woman's Guide to Socialism and Capitalism* and the less demanding *Everybody's Political What's What?*

He also became an international celebrity whose opinion on any subject was good for a few lines in a newspaper. This notoriety had its good, if exhausting, side (his welcome in Russia and New York), but it tended to turn him into an oracular clown as more and more people failed to realize that wit was a vehicle for substance, not an end in itself. He came to decry the "worship-

Photographed by Stephen Wilkes for the Magazine Publishers of America, © 1988.
Why did "Company A" have breakfast with "Bank B"? Maggie tells me.

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pers of my publicity," the crowd "that follows me about caring not two straws whether I am advocating Purdah or Promiscuity." The letters, even the playful and outrageous ones, put the clown to rest and reaffirm the Shaw who believed in his ideas and his powers of observation, and who felt that they were best expressed in ways that entertained an audience—even an audience of one.

The range of topics in the collection is so wide that one can do no more than hint at them in a short review, but among them are letters on many of Shaw's continuing preoccupations: music, phonetics, illustration, education. There are business letters that are rapaciously reasonable, and personal ones that show him masking kindness with a sharp tongue. There are surprisingly gentle letters like the touching recollection of critic Edmund Gosse that he sent to Gosse's son after his father's death. He writes a great deal about the past as he tries to aid or discourage or set straight biographers and would-be biographers, and to supply information to distant relatives and old friends who are trying to shore up their own memories. There are descriptions of his travels, of which his letter to Sister Laurentia McLachlan on the Holy Land is particularly impressive.

For me, the most interesting letters are those about theatrical (or film) production, and those that show him struggling to deal with a political world more lethal than the one in which he grew up and began to grow old. Since he was less immediately involved in theatrical production during his last years, there are fewer directorial letters in this volume than in the earlier ones. Still, there are fine examples in which he tells an actor how to polish a performance, and a director how to rescue a work from misinterpretation; as always, his comments are detailed and specific. Given the too-cute revivals of Shaw plays we get these days, it would be rewarding if contemporary theatrical folk would heed his advice to play the verbal variety in his lines, to keep the set from distracting the audience from the characters, to avoid movement for movement's sake, not to "throw away a leading part for the sake of laughs that any stage funny man can get as easily as drawing corks."

The political letters are sadder. "The wisdom of the people is a myth," he wrote Beatrice Webb in 1941, but he had been complaining for years that de-

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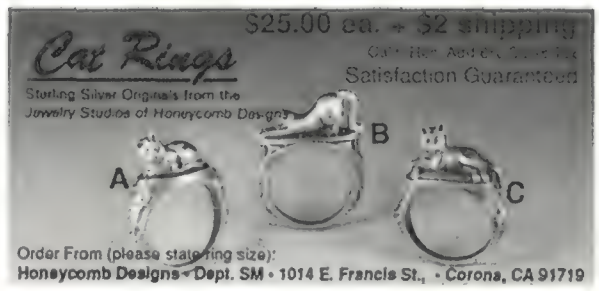
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mocracy would never lead to the socialism he advocated ("equality of income"). As his plays indicate, he had always been fascinated by the strongman, the superman, and felt that only through such a figure could the inequities of society be corrected. For that reason he was attracted to Mussolini, to Stalin, even to Hitler—until he realized that the anti-Semitism he at first thought an aberration was central to the German dictator's program. None of these men was Shaw's rational Caesar (even Caesar wasn't), but his impatience with the parliamentary system made him try to re-create them in Caesar's image.

The last part of the book is sad in a different way. He was a remarkable man, busy right to the end of his life, but there was an inevitable falling away of his powers. "Forgive senile garrulousness," he wrote in 1942. He was never senile, but he did become garrulous, lose some of the sharpness of his best days. Who does not? "I am now in my 80second year, which means that my death may occur at any moment," he warned his publisher in 1937. "Indeed, actuarially, I am dead already." Increasingly, as his wife, his friends, his old associates died, he said that he ought to die or that he was dead. There is no self-pity in these statements. For Shaw, death—like his growing fragility—was a matter of fact. "The years are inexorable: you cannot imagine how dotty I am, though I can still write a bit." The important thing was to go on with his work, although much of his last work was a tidying up in preparation for his departure. The last letter in the volume is a note to a neighbor, apologizing for the smoke from his burning of dead trees. It ends with a reference to the crematorium: "I shall be burnt up myself presently; but the fumes will get no farther than Golders Green." Two months later he made that trip to Golders Green.

Gerald Weales, Professor of English, University of Pennsylvania

Merlin
Norma Lorre Goodrich
Watts, $24.95

"There are more things in heaven and earth, Horatio," wise Hamlet says, "than are dreamt of in your philosophy." Precisely, and the legendary figure of Merlin—King Arthur's mentor and the wily magus of medieval British lore—is surely one of them.

Consider, for instance, how I came to write this review. The chronology is startling. Tuesday: I wander into a secondhand bookshop. There, atop a new consignment of books, is C. S. Lewis' metaphysical thriller, *That Hideous Strength*. Written in 1943, it is often considered science fiction.

In fact, it is really a modern go at medieval romance, revolving around the problem of good and evil on our planet. The magical spirit of Merlin is at the book's core, insistently pointing a bony finger at all those rogue, unexplained happenings that plague our dreams. So, well into the night, I read about Lewis' thoroughly modern Merlin.

Wednesday morning: I meet with a SMITHSONIAN editor. In passing, he suggests that I take a look at a new book: Professor Goodrich's literary, archaeological and linguistic search for the real Merlin, as he existed behind centuries of myth. Pinch me, quick.

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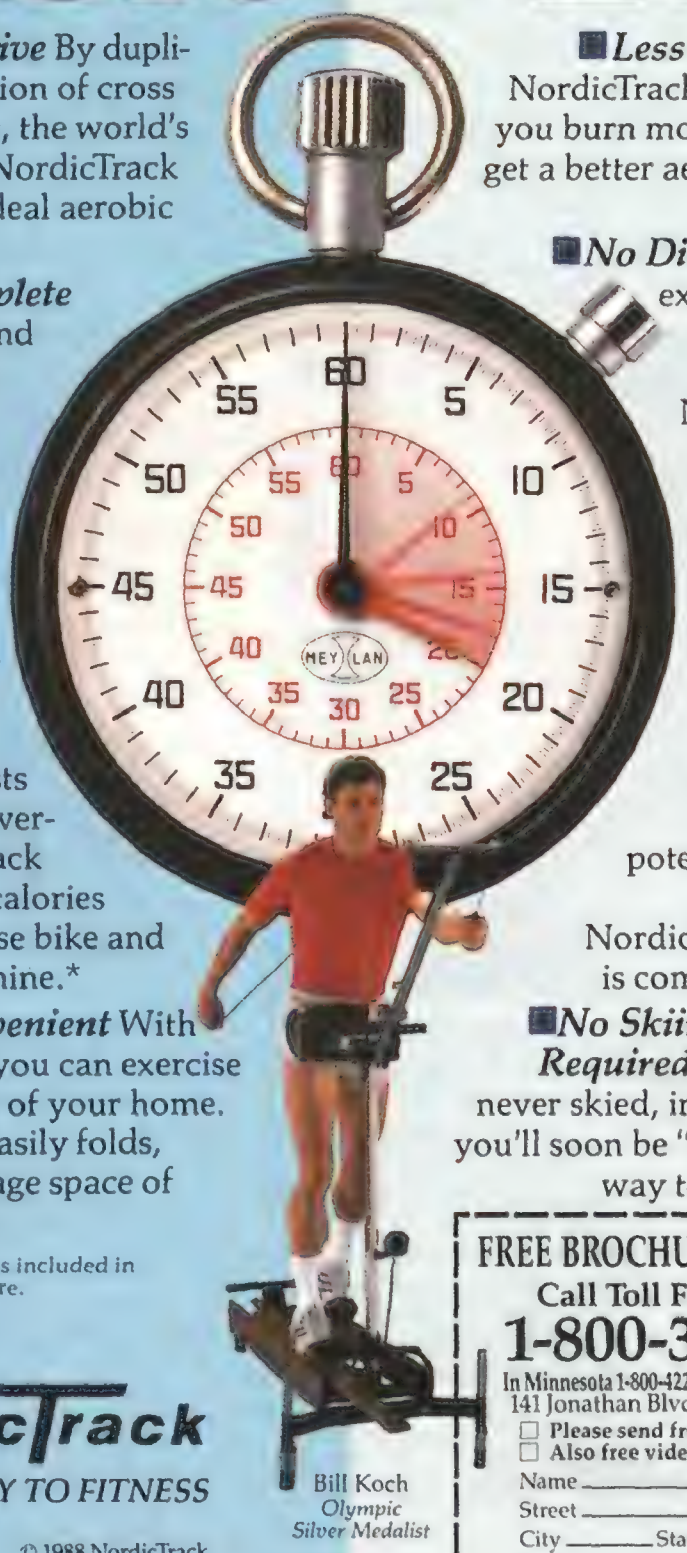

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Goodrich has produced an enchanting volume, largely because she depends so thoroughly on medieval literary sources. In fact, she includes her new translation of portions of Geoffrey of Monmouth's *History of the Kings of Britain* (Latin) and some of the anonymous *Prophecies of Merlin* (Old French), which she believes have not been translated before.

Literary sources have always been a minefield for scholars working on King Arthur and his circle. The problem? Time. Say King Arthur flourished in the sixth century, if he ever existed at all. Why is it that five centuries drag past before the Arthurian tales explode into the English literary imagination?

Arthurian manuscripts then continue to appear at a modest clip until the next apogee, with Sir Thomas Malory in the mid-15th century. Remember how King Henry VII named his firstborn Arthur, hoping to usher in a Tudor Camelot?

Looking backward, the distance between our time and Malory's is barely half the distance between Malory's and the date when Arthur and Merlin were said to have lived. That's quite a dark and tangled wood for the confusing of the record.

Merlin brought about the birth of Arthur, engineered the sword in the stone, won battles as Arthur's strategist, even had a much more interesting love life than his protégé—at least with the Lady of the Lake. And did she kill him? Goodrich makes a good case that she didn't—she just presided at his demise. Nor is Merlin actually dead, Lewis says. He is merely buried, asleep. He, too, will return when Britain needs him.

Today, the questions are two: Is Merlin a historical figure or merely a fictive one? Ditto for King Arthur.

There probably was an Arthur, who as a Romano-British warlord waged battles against the challengers from the west—from Ireland and Wales—and from the Picts of the north. Most of his activity would have taken place in the west and north, in the border counties, nowhere near Stonehenge.

Similarly, Goodrich says Caerleon in Wales is a confused reading of Carlisle in Scotland. This hint gave rise to her candidate for the real Merlin, Saint Dubricius of Wales. Prophet and founder of several colleges and monasteries, Dubricius taught in both Wales and Scotland, and as archbishop of Carlisle is said to have crowned Arthur.

C. S. Lewis thought the tales were

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portraits of Britain as it must have been at the bitter end of the Roman empire. He speculated, "Wouldn't there have been one section of society that was almost purely Roman? People wearing togas and talking a Celticised Latin—something that would sound to us something like Spanish: and fully Christian. But further up country, in the out-of-the-way places, cut off by the forests, there would have been little courts ruled by real old British under-kings, talking something like Welsh. . . .

"One can imagine a man of the old British line, but also a Christian and fully trained general with Roman technique, trying to pull this whole society together and almost succeeding. There'd be jealousy from his own British family, and the Romanized section—the Lancelots and Lionels—would look down on the Britons. That'd be why Sir Kay is always represented as a boor: he is part of the native strain. And always that undertow, that tug back to Druidism."

Lewis asked, "Has it ever struck you what an odd creation Merlin is? He's not evil; yet he's a magician. He is obviously a Druid; yet he knows all about the Grail."

Down deep, in this postscientific age of ours, we pride ourselves on a flinty resistance to the occult. No less a man than Shakespeare did too. That is, until that last speech from the mouth of his magician, Prospero. With it, the Bard tells us that art is the ultimate magic. Prospero *is* Merlin. And lives, just as he always will.

Michael Olmert
Writer, *Smithsonian World*

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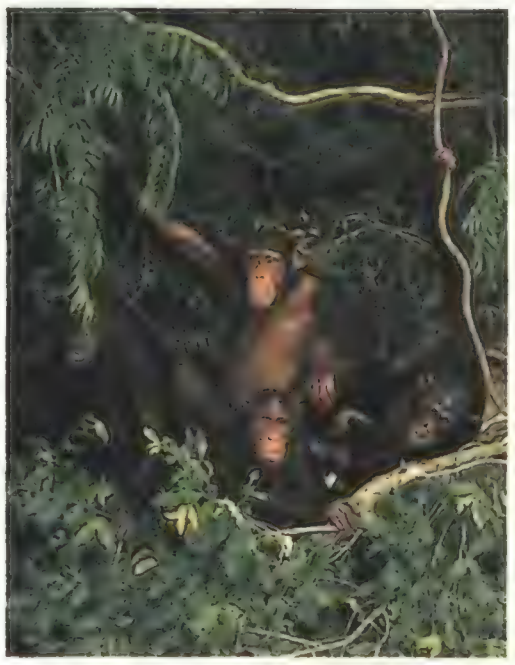

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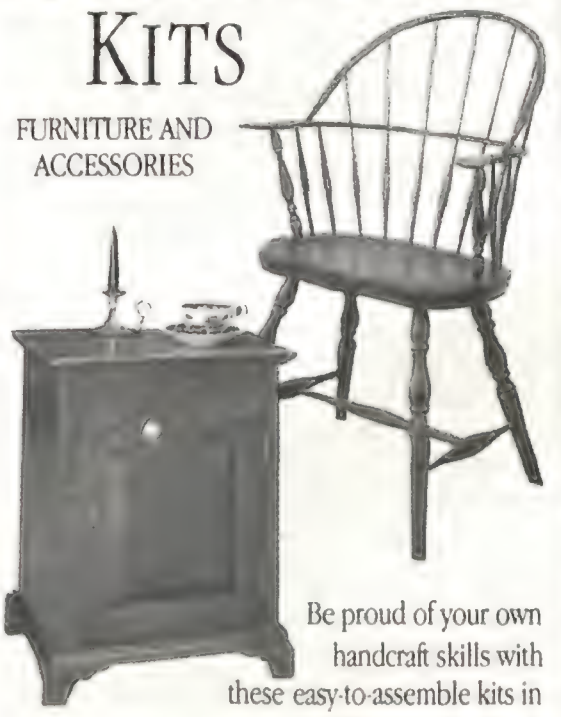

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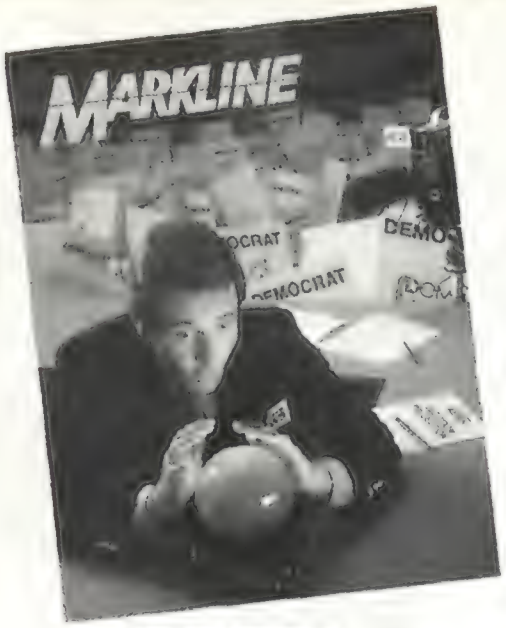

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Smithsonian highlights

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Freer closing

On September 6, the Freer Gallery of Art will close for approximately three years as a renovation and construction project linking the museum with the Sackler Gallery begins.

New Air and Space Restaurant

The dining facility on the museum's east terrace is open.

Special September exhibits and events

Hirshhorn Museum & Sculpture Garden
Alberto Giacometti: 1901-1966 (September 15-November 13) Sculptures, paintings and drawings in the first American survey since 1974 to honor the Swiss artist (see page 112).
Russian and Soviet Paintings, 1900-1930 (through September 25) First significant American showing of works devoted to early 20th-century artists.

National Museum of American Art
Lucas Samaras: Objects and Subjects 1969-1986 (through October 16) Sculp-

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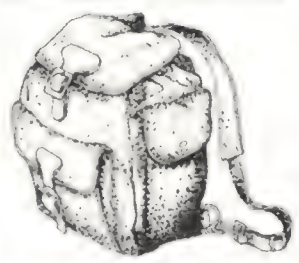

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Frank Lloyd Wright: In the Realm of Ideas (through September 30) Artifacts, models, Usonian Automatic House.

National Portrait Gallery
Polaroid Portraits (through December 4) Remarkable ways Polaroid film has been used to make portraits.

National Museum of Natural History
Crossroads of Continents: Cultures of Siberia and Alaska (September 23-April 2) First jointly curated Soviet-North American exhibit ever organized: history, art and traditional cultures seen through 500 artifacts.
Places of Power: Sacred Sites of America and the Pacific (September 9-January 8) Hand-painted photographs by Corson Hirschfeld.

Arthur M. Sackler Gallery
Art of India: Painting and Decorative Objects (through December 31) Fifteen pieces, 13th through 19th centuries.

International Gallery, S. Dillon Ripley Center
Tropical Rainforests: A Disappearing Treasure (through January 2) Five floor-to-ceiling film screens, photos, models.

National Air and Space Museum
European Space Agency Overview of recent scientific missions includes full-scale models of four spacecraft.

Cooper-Hewitt Museum (New York)
What Could Have Been: Unbuilt Architecture of the '80s (through October 16) Drawings and models by architects and environmental artists.
Burghley House: The Countess' Gems (September 6-November 27) Jewels and ornate stone vessels.

Exhibition catalogs

Catalogs available currently include:
Alberto Giacometti (paper, $24.95; cloth, $50)
Russian and Soviet Paintings, 1900-1930 (paper, $24.95)
People of the Tropical Rainforest (paper, $19.95; cloth, $39.50)
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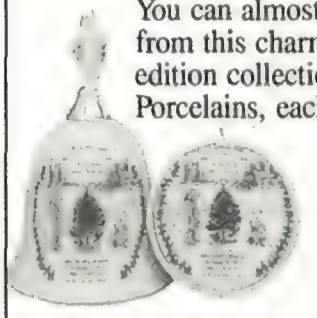

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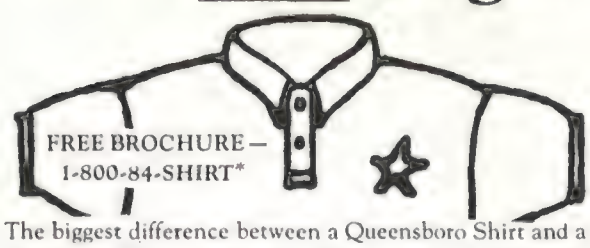

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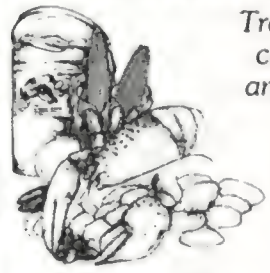

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Powaqqatsi (September 25: dinner, 6:15; film, 8 P.M.) Exclusive preview of the spectacular film on Third World cultures, score by Philip Glass.
New Frontiers of Science (six sessions, September 26-November 21, 7:30 P.M.) Leading scientists report on current research in their fields.

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Ashland, Kentucky (September 10-October 9) *Mexico as Seen by Her Children*, Paramount Art Center Gallery.
Birmingham, Alabama (September 10-October 9) *Field to Factory: Afro-American Migration, 1915-1940*, Birmingham Central Public Library.
Chicago, Illinois (September 7-December 10) *Gauguin and His Circle in Brittany: The Prints of the Pont-Aven School*, Art Institute of Chicago.
Salt Lake City, Utah (September 10-October 30) *Diamonds Are Forever: Artists and Writers on Baseball*, Utah Museum of Fine Arts. See *Highlights continued* (p. 184).

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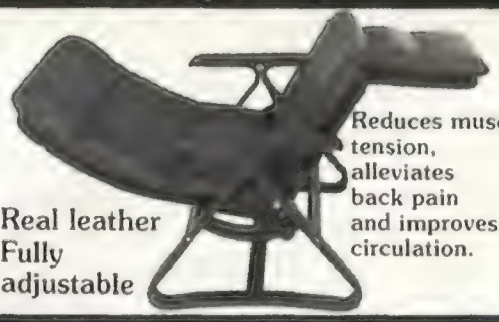

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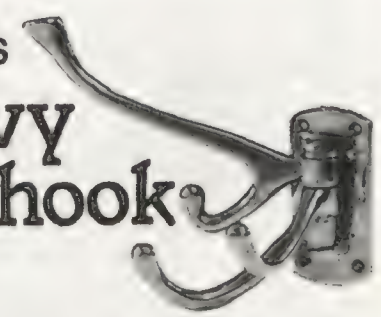

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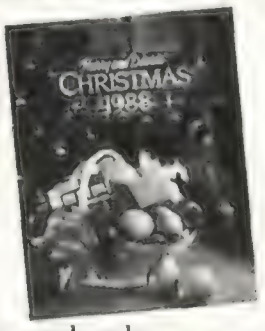

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Highlights continued

From Albany, a feast for fans

Is it the arc of the perfect curveball? Or is it an outfielder's superhuman agility? Or could it be the hotdogs?

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This show's handsome companion book, which was reviewed in last April's SMITHSONIAN, is a treat in itself. But true-blue baseball aficionados will also want to take in the exhibit that evokes the peculiar magic of the national pastime.

As the World Series approaches, "Diamonds" celebrates everything we savor: ballparks and players, double plays and trusty gloves, Louisville Sluggers and stadium nights.

Some images—Raoul Dufy's watercolor of Fenway Park, for instance—call up the big leagues. Others dwell on sandlot pleasures: Joel Meyerowitz's photograph of an afternoon's Little League game in Provincetown recalls the slow, spellbinding power of the sport.

Writings range from Garrison Keillor's engaging meditations on "the dark twilight of my slow-pitch career" to Ernest Hemingway's paean to Joe DiMaggio.

The continuing SITES-New York State Museum show opens September 10 in Salt Lake City, then moves on to Houston, Baltimore, Chicago, Oakland and New York.

Kathleen M. Burke

Jacob Lawrence's *Strike*, 1949, painted when artist lived in Brooklyn, evokes glory days.

Michael Langenstein's Sistine spoof suggests that "In the beginning, there was baseball."

Andy Warhol's screen-print portrait of Pete Rose has source in baseball cards.

The Wide Swing, Harvey Dinnerstein's tribute to legendary Joe DiMaggio, extols the heroic dimensions of the game.

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Domestic Study Tours

West by Rail September 23-26 or 26-29: Travel by private, restored train from Denver to San Francisco, or vice versa.

California Wine October 2-8: Learn to select, enjoy and evaluate wines from Napa, Sonoma and Mendocino.

Florida Keys October 22-28: Coral reefs, hardwood hammocks and tide pools are studied during a sojourn on Big Pine Key with marine biologists.

Okefenokee November 1-6 or May 2-7, 1989: For novice or expert canoeists; discover the beauty of this wildlife refuge near Jacksonville.

Smithsonian Sampler Weekend November 11-13: For all ages. Private tours highlight collections at selected museums.

Christmas at the Smithsonian December 2-4: Welcome the holidays with tours, music and festive dining.

Christmas in Asheville December 23-26: Celebrate the holiday at North Carolina's historic Grove Park Inn.

Hawaii January 22-February 3 or February 12-24: Explore the diversity of four islands on this active nature tour.

Florida Springs February 6-10: Canoe the freshwater springs of central Florida and see the endangered West Indian manatee.

Baja Whale Watch February 23-March 3: Aboard the *Royal Polaris*, follow gray whale migration from San Diego to Scammon's Lagoon, with stops at several islands.

Death Valley March 7-16 or 20-29: Explore the mountains and canyons of the Mojave Desert area on foot and by van.

Big Bend March 22-31: Hike in this wild and scenic park; also visit Carlsbad Caverns and McDonald Observatory.

Sojourn in Tucson April 1-8 or 15-22: Local experts provide an overview of the area's multiethnic folklore and natural history.

Foreign Study Tours

People's Republic of China A variety of unique itineraries in September and October. Tours designed for new and repeat China travelers.

Sicily September 23-October 6: Study and explore this ancient island crossroad in the Mediterranean.

Rhineland October 4-20: Stay in Heidelberg before cruising the picturesque Rhine and Mosel aboard the M.S. *Europa*, pride of the Rhine River fleet. Tour ends in historic Cologne.

Japan Journey October 9-22: An excellent overview of Japanese culture in Kyoto, Tokyo and the countryside.

Australia-New Zealand October 16-November 8 or February 5-28: A highlights tour that includes wondrous wildlife and intriguing cultures.

NEW Seminar in Egypt October 23-November 9: Lectures at American University in Cairo enhance a four-day cruise that visits ancient sites from Aswan to Luxor.

NEW India Arts and Crafts November 4-26: Unique program focuses on village artisans; also includes trips to Agra, Ahmedabad and Bombay.

Thailand November 6-24: Enjoy colorful cities, remote villages and archaeological sites in this exotic country.

NEW Argentina November 6-27: Explore fantastic natural and historical diversity from the wildlife spectacle at Valdés Peninsula to remote parts of the panoramic northwest.

Smithsonian Christmas: Enjoy the holidays on the tropical island of Fiji or in the warm climate of New Zealand; or celebrate in one of four idyllic European settings including England (Winchester or Canterbury), Austria and Switzerland.

Antarctica and Falkland Islands December 27-January 12: Aboard the M.V. *Society Explorer*, thrill to spectacular scenery, visit research stations, photograph wildlife, learn of historic explorations.

Mesoamerican Study Programs January and February: Yucatán, El Tajin or Guatemala.

Backstage London January 1-11: Attend traditional and avant-garde productions, meet performers backstage.

South America Voyage January 6-30: Cruise Brazil, Argentina, Cape Horn, Chile. Includes Iguaçú Falls and Santiago.

NEW Leningrad Arts Seminar January 14-22: An overview of art, architecture, history with visits to the Hermitage and Russian museums. Pre-trip program in Washington features Hillwood's Russian collection.

Kenya-Tanzania Wildlife Safari January 21-February 7: A unique journey to East Africa.

India Wildlife Safari January 22-February 18: Travel by elephant and jeep to observe rare species of birds and animals in India and southern Nepal.

NEW Paris in Winter February 8-17: Experience art, theater, commerce, cuisine and more, in the quiet of the nontourist season.

Red Sea Passage February 16-27: The splendor and mystique of ancient Egypt are revealed during this exotic ten-day cruise.

NEW Budapest Music Festival March 15-26: International performers gather to celebrate musical traditions.

NEW Sea of Cortez March 19-29: Cruise Mexico's Gulf of California. See blue whales and other wildlife.

NEW Jamaica March: Study the customs and culture of this delightful island.

Costa Rica March 25-April 8: Learn about flora, birds and other wildlife in the American tropics.

Kyoto Seminar March 25-April 9: Reside in a traditional Japanese ryokan. Explore language, history and culture.

Berlin April 12-26: An intimate look at the fabulous Berlin, East and West. Includes travel to Dresden, Wittenberg and Weimar.

European Countryside Programs Spring-Fall 1989: Reside in scenic and historic areas of England, France, Germany, Austria, Hungary, Italy, Switzerland, Wales or the USSR.

Write Smithsonian National Associates, 1100 Jefferson Drive SW, Washington, DC 20560 or call (202) 357-4700 for tour brochures

Washington

Smithsonian Seminars

East meets West in Washington this fall when two superb exhibitions bring the arts of Japan, Siberia and Alaska to the Mall. Discover the remarkable cultures of the North Pacific or the national treasures of premodern Japan during exhibition tours, lectures and films in the company of distinguished experts and fellow Associates who share your special interest.

Crossroads of Continents: Cultures of Siberia and Alaska
November 2-5

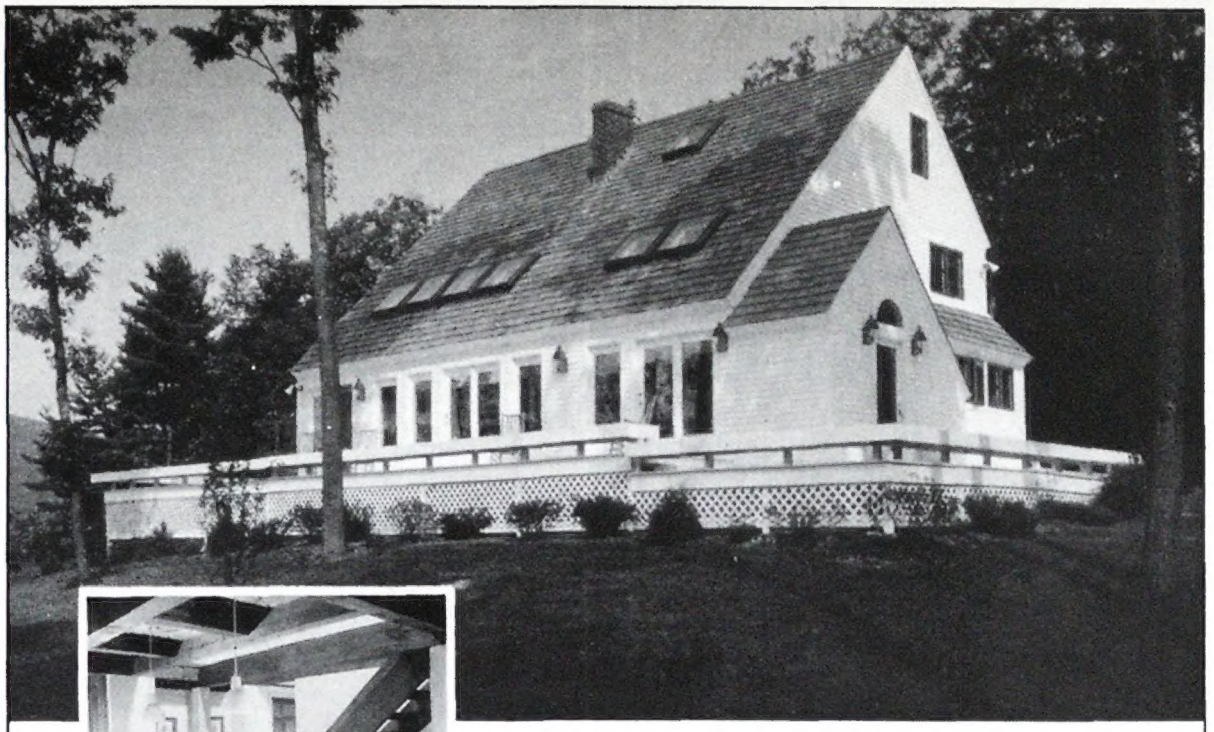
Explore the varied cultures of this remote region at the National Museum of Natural History. See more than 500 objects from the Chukchi, Koryak, Nanai and Even people of Siberia, and the Aleut, Eskimo, Athapaskan and Tlingit tribes of Alaska. Learn the fascinating story of this landmark exhibition, the first ever to be jointly organized by Soviet and North American museums. Study the belief systems expressed in art forms ranging from intricate basketry and beadwork to delicate carvings, and ingenious tools to exquisite clothing. Gain a new understanding of how these people adapted their harsh yet bountiful environment as you view fascinating documentary films.

Japan: The Shaping of Daimyo Culture 1185-1868
November 2-5

Be among the first to enjoy this splendid exhibition of more than 450 historic objects including lacquer ware, ceramics, screens and paintings at the National Gallery of Art. Learn about the daimyo, powerful feudal lords of premodern Japan, under whose devoted patronage the arts flourished for several centuries. Tour a private collection of Edo period fans and scroll paintings, and see exquisite Japanese objects from the daimyo period during specially arranged visits to the Sackler and Freer Galleries. Discover how Japan's time-honored Noh theater combines mime, dance, song, poetry and music into a unified spectacle, and enjoy a colorful evening performance of the classic Noh drama *Tsuchigumo*.

The seminars include an opening reception, private exhibition tours and three days of instruction. Optional hotel accommodations are available at the Capitol Holiday Inn, conveniently located two blocks from the National Mall. Watch this column for announcements of seminars coming up in January and April 1989.

or (202) 357-1350 for seminar brochures.



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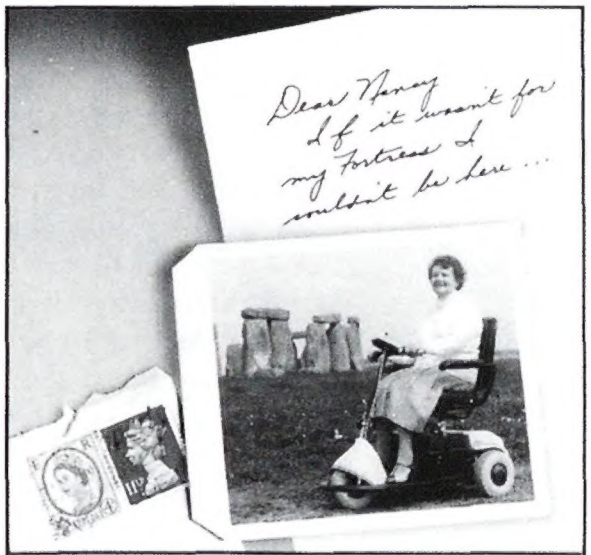

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By Churchill Payne

A new Pre-Primer in the halls of academe

My son has turned 5 and gone off to school. On the morning of his first day, he showed up at the barn door in khaki shorts, a yellow sport shirt and blue sneakers. His blond hair was wet and combed neatly back. His teeth were brushed and his hands were washed. He stood in the doorway, a small boy smiling, eager to take on higher education.

Cody, our English setter, nudged my son's right hand. This was a ritual with them. My son always had a treat, some delicious surprise for Cody. But not today. And Cody walked back into the barn with a perplexed look on his mottled black-and-white face. Even he seemed to know that things had changed, that something new was taking place.

My wife waited in the driveway, camera in hand, a mother determined to keep her son 5 years old and in short pants forever. A week later, we got the pictures back. They came out blurry. A boy's life, it seems, is nearly always slightly out of focus. Perhaps she should have known that it is impossible to get a clear snapshot of a young boy speeding through time.

My son's school is an orderly collection of red brick buildings a half-mile outside of town. In the sprawling schoolyard is the heady smell of freshly mowed grass, chalk and thick paste. On that first day, a warm wind blew among the high branches of red oaks, sweetgums and magnolias. Perhaps a hundred well-scrubbed children milled about, most of them first- and second-graders already broken to harness.

My son has a different title. He is a Pre-Primer, and thus of an age where restlessness and curiosity are still tolerated. He and 12 of his mates meet daily in a cinder block building the size of a motor home. Inside are four tables, six wooden benches, and shelves that hold enough of the world's magic and wonder to keep junior scholars busy and intrigued for the next six months.

Each student's seat is marked by a bright blue name tag cut in the shape of a different animal. My son took his place in front of what appeared to be a blue woodchuck. He is seated between two girls, a blue lamb and a blue lioness. It never occurred to him before that education might involve girls! The lioness, a redhead with freckles and bright green eyes, took one look at the blue woodchuck and burst into tears. She wanted to sit next to the lamb. Education in the Pre-Primer building had gotten off to a shaky start.

My son's teacher is a stout woman with tweedy gray hair and a substantial voice. "And what do you like?" she asked my son firmly. "Reptiles, soccer and fishing," he answered enthusiastically, thinking suddenly that nothing could be so bad that stuck to whatever a boy liked.

The teacher moved quickly to the blackboard and announced that the students' first assignment would be in the taxing field of coloring. She threw the assembled parents an annoyed stare and we all slipped out the door, leaving a good part of our children's future to chance. One of the children inside let out a protest that drifted through the classroom window and into the schoolyard: "Too much art makes me sleepy."

The parents, meanwhile, withdrew to the school's brightly painted gymnasium for a brief orientation by the principal, another stout woman with gray hair. In a soft and sympathetic voice she offered some words about "the crucial areas of education." These included verbalization, the lamentable influence and popularity of television, vocabulary utilization, motor coordination, spatial relationships, group interaction, school uniforms, progressive nutrition and prompt tuition payments.

A tour of the school grounds followed. In the library I stopped to thumb through an edition of Lewis Carroll's *Alice's Adventures in Wonderland.* It had been a long time since I had sat at a small wooden desk and followed the wide-eyed Alice down the rabbit hole.

My son's first brush with education lasted half a day. When I showed up to collect him, he was waiting patiently outside his classroom. Instead of his baseball cap, he was wearing an Indian headband fashioned from ragged strips of red, black and yellow construction paper. He sat on the thick roots of an oak tree. I sat beside him. We shared a cold root beer. I asked him how he liked school so far.

"Pretty good," he said calmly. "My coloring needs to get better."

"Everyone's coloring could be better," I reassured him.

"I had to tell something about us," he said shyly. "Everyone had to tell something about his family."

"And what did you say?" I asked, trying to conceal my urgent curiosity.

"I said we live next to the creek. There are trout in the creek. Sometimes we fish for them. But we never keep them because you don't kill special things like trout."

The air was warm and the sky had cleared and there was only a little wind from the southwest. My son picked up his new box of crayons and we went home. And for the rest of the afternoon, he stayed outside watching a big black-and-yellow spider mend its web and trap bugs near the garden. He had grown so much in that afternoon and with so little fanfare. There were so few sounds, and at sunset there was only the sight of the confident spider and the boy in the bold Indian headdress sitting nearby, looking at the swift-moving waters of the creek and dreaming.

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